YC 10167

Ex-libris
Charles Atwood
Kofoid

THE LIBRARY
OF
THE UNIVERSITY
OF CALIFORNIA

PRESENTED BY
PROF. CHARLES A. KOFOID AND
MRS. PRUDENCE W. KOFOID

MOUNTAIN CRAFT

Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

http://www.archive.org/details/mountaincraft00younrich

THE ALPS [SYDNEY SPENCER

MOUNTAIN CRAFT

EDITED BY

GEOFFREY WINTHROP YOUNG

WITH 28 ILLUSTRATIONS

NEW YORK
CHARLES SCRIBNER'S SONS
1920

.G510
Y6

TO

THE MEMORY OF

GALLANT COMRADES IN THE MOUNTAINS

FRANK BERGNE
GUY BUTLIN
C. K. CARFRAE
FOSTER CUNLIFFE
G. T. EWEN
E. N. FINLAY
R. W. FLETCHER
W. G. FLETCHER
H. O. GIBSON
EDMUND HARTLEY
S. W. HERFORD
TERENCE HICKMAN
TREVENEN HUXLEY
H. O. JONES
MURIEL GWENDOLEN JONES
E. L. JULIAN
HORAS KENNEDY
F. M. LEVI
JOSEF LOCHMATTER
FRANK LUCAS
SIDNEY McDOUGALL
NIGEL MADAN
KENNETH MOORSOM
L. E. NOON
L. OPPENHEIMER
HUGH POPE
KENNETH POWELL
PAUL PREUSS
J. E. RAPHAEL
C. J. REID.
C. DONALD ROBERTSON
JACK SANDERS
H. JONES-SABIN
LAURENCE SLINGSBY
MORRIS SLINGSBY
FRANK SPARROW
WILBERT SPENCER
THOBY STEPHEN
LOUIS THEYTAZ
H. W. THOMAS
J. M. ARCHER THOMSON
ERIK TODD
KENNETH TRAYES
GEORGINA MARY TUKE
HARRY WALKER
CHARLES WERNER
C. A. WORDSWORTH
C. S. WORTHINGTON
LAWRENCE C. H. YOUNG

PREFACE

THIS book is for mountaineers; and a mountaineer is not only one who climbs mountains, but anyone who likes to walk, read, or think about them.

I do not myself attach much value to mountaineering handbooks: an open-air pursuit can only be learned by practical attempt and from good example. I used to read them for the fun of surprising some hero of my youth as he strained his imagination to squeeze a grave principle out of a random holiday memory, and for the sympathetic pleasure of reconstructing for myself the real day of irresponsible adventure the recollection of which was bringing a thrill of forbidden joy to his mind before he composed his face to inflict it upon me in the form of an edifying three-line precept. I can read them now no more than I can read the 'climbing accident' type of fiction popular with magazines, which used to provide a less sensitive digestion with some acrid food for mirth. On the other hand I would still set myself to learn Chinese, if that would enable me the better to understand one more record of genuine mountain adventure or discover some unfamiliar attitude of the human mind towards the mountains and their symbolism.

I do not expect other mountaineers to read, or to refrain from reading, these opinions in a different spirit. Mountaineering, like other arts, has suffered much, for all its youth, from the limitations imposed by hasty tradition and by doctrine prematurely crystallized; and,

M313401

as in other crafts, if ever a period comes that shall find the traditional rules too rigid to admit of a wholesome influx of new and original conception, mountaineering will cease to deserve the name of an art or craft, and become at best an ' organized game.'

But the opinions as they stand may yet serve a limited purpose. Some men are born climbers. They will learn little about climbing from precepts. At the same time many of the finest climbers fall short of our ideal of safe method because they have never concerned themselves with the possible existence of any fundamental principles governing the various unrelated movements in which they delight ; and so it comes that, though they may do nine things, by instinct, right, they do the tenth, by habit, wrong. For these climbers I am not without hope that the statement, made I believe here for the first time, of the principles which underlie all correct climbing motions, and which have been steadily emerging during fifty years of practical mountaineering, may not be entirely useless. If they find that nine spokes of their practice lead back to my hub, and the tenth does not, they may learn how to correct the tenth. If, on the contrary, they find that only one leads back to it, and nine radiate elsewhither, well then, no doubt they will decide that I am wrong.

But whatever we may be as climbers, no one of us is a born mountaineer. Mountaineering, in its wider aspects, can only be learned by experiment ; and even the natural climber may be able to get some guidance from the collective expression of other men's mountaineering experience.

Many efficient climbers, again, never bother themselves at all with mountaineering as a craft. They simply take its pleasures, and leave its responsibilities to guides or to chance. Mountaineering will profit, if they can be led to discover something of all that they are missing.

More of us are, in a sense, specialists ; interested in one department alone, and neglectful or ignorant of

the rest. For such of us there is some benefit in surveying, if only superficially, the immense field that a man must set himself to traverse who aspires to lead a party safely.

Yet another group, with whom I have a particular sympathy, who belong to the class of ' made ' climbers rather than to that of ' natural ' climbers, may often find that they have stuck fast at a certain point in their technique and are abandoning the prospect of improving further. Experience encourages the hope that they may be able, after learning something of the essential principles of method, to recast or amplify their own methods, so as to make further progress on sounder lines. Or they will discover that a man may be useful to a party as an expert in one of the less common but no less important branches of mountaineering craft. Their inferiority in a single department—for instance, rock climbing, in which excellence is often overrated as compared with other equally valuable qualifications—will then be seen in better proportion.

And those who are not climbers, but who are interested in or perhaps even resentful of the fascination which mountains exercise, may discover, if they have the patience, that mountaineering as it is now practised is no simple outlet for an athletic impulse, and no selfish indulgence in a game which has the demerit of risking lives often of notable value; but that it is a genuine craft, as well as a genuine enthusiasm; an education alike in self-development and in self-subordination; a discipline of character, of infinite variety in its demands and in its reactions upon strength, endurance, nerve, will, and temper, upon powers of organization as upon powers of dealing with men; a test of personality for which no preparation may be considered excessive, and a science for whose mastery the study of all our active years is barely sufficient. Of its rewards, in health, self-knowledge, æsthetic pleasure, and incomparable adventure, it is not the place to speak in a book of practical counsel.

For the opinions on technical points, and their elaboration in theory, I must be held alone responsible. Where the multiplication or repetition of detail may appear tedious, it has been inserted for the better illustration of some underlying principle, or to provide the more material for the future settlement of some point still under discussion among mountaineers. Those who disagree with the methods recommended may still make use of the advice, much as I should do in their case, treating it as yet another statement of an individual point of view, such as may at least act as a serviceable standard of comparison for their own practice.

Our object will be gained if the suggestions are found to provide a basis for more general discussion and thought, an available condensation of a good deal of theory floating and partially formulated among modern mountaineers of experience, and something of a book of reference and reminder for those who may not have known, or cared to admit, that there was so much about which they ought to form an opinion.

In the innovation of giving a prominent position to considerations of personal management and leadership there has been a special purpose. For reasons not difficult to assign, most manuals dealing with the practice of active pursuits have been in the habit of ignoring the dominant influence that is exerted upon all combined action by the psychological factor, and the extent to which changing conditions of mood and humour, and the more stable divergences between the individual temperaments of men acting in association, must contribute to success or failure. The accentuation of the human problem, as it presents itself in mountaineering, has therefore been intentional. In mountains, where personality counts before everything, men are forced back upon their elemental selves ; they become very different beings from their drawing-room semblances, and unless they allow for this in the adjustment of their

relations on the hills, they can achieve only the mediocrity of performance, the barrenness in results, or the complete break-down which are the common fate of all ill-constituted parties, for exploration, for mountaineering, for warfare, or for any other active adventure that depends for its success upon effective combination.

Mountaineering, in its modern development, involves a large number of matters for arrangement which cannot be classed under the headings of technique or of specific equipment for climbing; such as methods of travel, care of health, choice of districts in less-known countries, special routes of access, and details of topography and equipment peculiar to any particular district chosen. Most of these vary in detail in the different ranges.

It has, therefore, seemed most convenient to deal with the special conditions which characterize a number of the regions now most frequently visited in separate chapters, each chapter devoted to one of the great ranges. These chapters have been undertaken by experts who will be recognized as speaking with authority by mountaineers of every school and nationality. Their intention is to give just the amount of practical information which we all need, and which we find it so hard to procure, when we are in process of making up our minds what region we will visit; and to add sufficient indication of where we may find all the more particular information which we shall require when once we have decided upon our region.

Captain Farrar's suggestions on Mountain Equipment, Mr. Arnold Lunn's on Equipment and Method for Mountaineering on Ski, Dr. Wollaston's on the Care of Health, and Mr. Sydney Spencer's on Photography, apply, generally speaking, to all mountaineering regions and to all organized expeditions. To Captain Farrar's advice the suggestions on Outfit made in the regional chapters are complementary, dictated by the special conditions of the district or of the season.

Besides that which is owing to innumerable contributors to discussions which have extended over many years and exercised a variety of languages, I have to acknowledge a very special debt of gratitude to Mr. H. V. Reade, C.B., for his helpful suggestions and careful revision ; to Captain Farrar, D.S.O., for constant encouragement and a characteristically kindly criticism ; to Mr. Oscar Eckenstein, for having most generously placed at my disposal the notes of much accumulated experience and illuminating inductive theory, and for having provided me with information and reminder in several of the less-known branches of mountaineering ; and to Mr. Sydney Spencer, Mr. Charles Mead, and Professor Norman Collie, F.R.S., for a group of illustrations, which may be found to lighten the practical detail of the text and serve as reminders of the beauty, the mystery, and the strangeness of the mountain world into which—safely and superficially or masterfully and understandingly, according to the degree of our preparation—the study of mountain craft purposes to enable us to penetrate.

June 1914

Six years ago these papers were sent in for publication. For my own share in them I made the decision, then, with some reluctance. In mountaineering there is always something new to learn, and they might all too soon need correction or amplification.

But the chance of battle which delayed their appearance has, in the event, confirmed the resolution. My colleagues have brought their regional contributions up to date: I have added the substance of the notes jotted down during my last climbs in July 1914 ; and I can now let the opinions go with much less hesitation, since from the annual demonstration of their deficiencies by their most obstinate critic they must, in future, be exempt. G. W. Y.

June 1920

CONTENTS

CHAP. PAGE

I. MANAGEMENT AND LEADERSHIP . . . 1
By the EDITOR

Management in anticipation — physical well-being — food — thirst—smoking—ailments—bathing—young folk—preventable humours—boredom—over-excitement. Leadership in action—the collective confidence—keeping touch—temper—abnormal moods — reaction—disappointment—over-confidence — hysteria —vertigo—the effect of height. Social composition of the party. Walking manners—some notes on hill-walking. Choice of district. Incidental duties—hut usages—consideration—some night notes—a last task. Weather—clouds—wind—signs in general—habit of the season—persistence. Training—the framework—the organs—will and nerves—nerve—height and reach. Pace —adjustment of time—benightment—weight handicaps—continuous going—combination—halts—the maximum rhythm.

II. EQUIPMENT FOR THE ALPS 80
By J. P. FARRAR

Equipment—boots—clothes—some alternatives (G. W. Y.)—costume for women (Miss BRONWEN JONES). Outfit—sack—axe—rope—knots—necessaries—bivouac—tent, etc.

III. GUIDED AND GUIDELESS MOUNTAINEERING . . 101
By the EDITOR

Old-time errors—the guide of the chronicles—the guide as he is—the amateur as he may be—the composite mountaineer—the guide as mountaineer—the amateur as mountaineer—the question for the leader—the social consideration—the technical compensation—examples—the expert—the tourist—the beginner — the moderate mountaineer — summary — a supreme example. Management of guides—guide nature—the right footing—before the ascent—on the mountain—fine shades—the terms of the association—the rare crisis—the reward.

CHAP. PAGE

IV. ROCK CLIMBING 138
By the EDITOR

A theory of the development—balance climbing—the individual standard—solitary climbing—initial practice—the use of the foot—hard soles—soft soles—foothold—anticipation—the ankle—the knee—the hand—cling holds—push and press holds—in cracks—on slabs—chimney climbing—rib riding—wet rock—glazed rock—summary. Unsound rock—semi-detached—detached—moraine and scree. Unusual rock—in quarries—along sea cliffs—on freaks. Climbing down—positions—facing outward—facing sideways—facing inward—down chimneys or cracks—the rope in continuous descent—the doubled rope—brakes—springing the rope—the long rope. Pegs and aids. The axe on rocks—carriage—the extra hand—the Manx leg.

V. CLIMBING IN COMBINATION 209
By the EDITOR

Collective rhythm—imitation—the rope while moving together—to the man in front—from the man behind—while moving singly—following and leading—stances—with belays—without belays—holding the rope—the order on the rope—on ascents and descents—on traverses—the order of merit—the order with beginners—the order of moving—the duties of first man—of second man—backing up metaphysically—backing up physically—of third man—more about the rope during climbing—with stones—during halts—coiling—suitable lengths—funicula.

VI. CORRECTIVE METHOD 256
By the EDITOR

Human fallibility—warning—easing—checking on traverses—the case of the end man—the measure of courage—the second man's action—after a fall—accidents. Mountain perversity—falling stones—snow slides—ice fragments—evil weather.

VII. ICE AND SNOW CRAFT 279
By the EDITOR

The age for glaciers. Ice craft—the nature of ice—ice-claws—cutting steps—using steps—the rope on ice—glacier work—snow-covered glacier. Snow craft—some characteristics and counter-moves—snow travail—snow slopes—the rope and axe—bergschrund and bridge—cornices—snow in couloirs—snow at home—confusing weather—the sense of direction. Glissading—on ice—positions—arrests. On snow—positions—steering—jumping — brakes — sitting — stone-tests — the rope — some variations—alternate glissading—face inward—plunging—on claws. On other grounds—on scree—in winter gullies—on grass and heather.

CHAP. PAGE

VIII. RECONNOITRING 370
By the EDITOR

Things seen—snow surface condition—angle on snow—snow cornices—wind and snow signs—ice—couloirs—rock—faces—ridges—slabs—rocks in Britain. The Half-seen. The Unseen.

IX. MOUNTAINEERING ON SKI 397
By ARNOLD LUNN

Technique—equipment. The alpine calendar. Snow craft. Winter snow—powder snow—the effect of wind on powder snow—the effect of sun on powder snow—summary of winter snow. Spring snow. The effect of Föhn and thaw—Föhn in winter—Föhn in spring. Summer snow. Snow avalanches. Classification of avalanches. Summer snow avalanches. Tactics on avalanche ground. The High Alps in winter—weather conditions—the approaches to the High Alps—snow conditions in the High Alps—rock ridges and ice slopes. Glaciers in winter—ski-ing on a rope. The High Alps in spring—March—April—May—June. The spring time-table. Summer and autumn ski-ing. Summer ski.

X. MOUNTAIN PHOTOGRAPHY 471
By SYDNEY SPENCER

Camera and apparatus—the choice of subject—colour photography—stereoscopic photography.

XI. MOUNTAINEERING IN TROPICAL COUNTRIES . . 479
By A. F. R. WOLLASTON

Health and remedies. Equipment—food—canteen—clothing—furniture—tents. Management—loads and packing—trade goods, natives, etc.—carriers—camps, and things in general.

XII. MOUNTAINEERING IN THE ARCTIC (SPITSBERGEN) . 497
By Sir W. MARTIN CONWAY

Modes of access—plans of campaign—from the coast—into the interior—exceptional phenomena—summary, cost, etc.

XIII. THE CAUCASUS 506
By HAROLD RAEBURN

Topography—literature—routes of access—modes of travel—centres—equipment—organization—maps—expense.

XIV. THE MOUNTAINS OF CORSICA 517
By GEORGE FINCH

Season—equipment—centres, access, and topography—nature of the climbing.

CHAP. PAGE

XV. THE HIMALAYA 522
By T. G. LONGSTAFF

General considerations—configuration—conditions—conduct of the campaign—season. Chief districts—Eastern Himalaya—Sikkim—Nepal—Kumaon and Garhwal—Tehri Garhwal—Simla Hill States—Kashmir and Karakoram—Hindu Khush, etc. Personal matters—expense—outfit—food—the high camp outfit—clothing—instruments.

XVI. THE MOUNTAINS OF NORWAY . . . 536
By W. CECIL SLINGSBY

Guide-books and literature—season—routes of access, travel, etc. — expense — equipment — guides — topography — local conditions.

XVII. THE SOUTHERN ALPS OF NEW ZEALAND . . 548
By MALCOLM ROSS

Routes of access—local conditions, guides, etc.—topography—flora and fauna—glaciers.

XVIII. THE PYRENEES 556
By CLAUDE ELLIOTT

Topography—centres—guides—maps—huts and inns—equipment—expense—literature.

XIX. THE ROCKY MOUNTAINS 572
By A. L. MUMM

Topography—the C.P.R. district—the Selkirks—guides and equipment—the Northern Selkirks—the Purcell range—some minor ranges—the main chain from Laggan to Jasper—the groups east of the main chain—the main chain north of the G.T.P.—modes of travel—outfit—season—the annual camps—access, cost, etc.

INDEX 593

LIST OF ILLUSTRATIONS

THE ALPS . . . . . *Frontispiece*
From a Photograph by SYDNEY SPENCER

FACING PAGES

KNOTS FOR USE IN ALPINE ROPES . . 92, 94, 96, 98
From Photographs by O. ECKENSTEIN

ROCK AND ICE 280
From a Photograph by SYDNEY SPENCER

MOUNTAIN ARCHITECTURE 370
From a Photograph by C. F. MEADE

SNOW WAYS 398
From a Photograph by JEAN GABERELL, Thalwil

THE HIMALAYA 522
From a Photograph by C. F. MEADE

NORWEGIAN PEAKS 536
From a Photograph by NORMAN COLLIE

IN THE TEXT

PAGE

TRICOUNI BOOT-NAILS 83

ICE-AXE 92

DIAGRAMS SHOWING SLOPES 426

SKETCH-MAP OF PART OF CIS AND TRANS-CAUCASIA . 507

SKETCH-MAP OF THE PYRENEES 558

MOUNTAIN CRAFT

MOUNTAIN CRAFT

CHAPTER I

MANAGEMENT AND LEADERSHIP

A PARTY consists usually of from two to four climbers, exclusive of guides. A larger number inevitably divides into two or more units for mountaineering purposes. The management devolves upon the most experienced mountaineer. His selection as leader, in this sense, is more often than not tacit and unexpressed, especially among British climbers.

Over-management is fatal to the effective co-operation of a party; and a formal selection of a leader [1], or a precise insistence upon the performance of particular duties by individual members, may only disturb the pleasant relationship of friends on a climbing holiday. If a man is not felt to be qualified as leader by personality and experience, no vote will make him so.

Large or democratic parties, of equal inexperience, can carry out very delightful sub-alpine wanderings without leadership. If they attempt serious mountaineering, it is usually at the cost to their friends of sleepless nights and of expensive search parties.

Among men of equal experience, equally able to grasp a situation and to co-operate without words of command, the duties of leadership are slight and their operation never obtrusive. Experience teaches them to accept, as a matter of convenience, the management of their daily routine by some one of their number, and to acknowledge, as a matter of security and of economy of time, the leadership of the most expert in the incidents

[1] Except where it is expressly stated, or is plain from the context, that the word 'leader' refers to the 'first man' on the rope, it is used of the most experienced mountaineer of a party, the one who exercises the functions of manager in matters of organization or arrangement and of leader or director in the actual business of climbing.

of the climbing day. In a pursuit so exacting as mountaineering, charged with the unexpected and dependent upon continuous harmony of action for its ordinary progress, some such voluntary subordination is essential. The leader may be only the focus of the collective opinion of an experienced party: like the conductor of an orchestra he may not be equally competent to play all the instruments he directs; but if there is no one to whom to look for the word, in mountaineering as in music the time is lost and the harmony vanishes for easy and for difficult passages alike.

In parties of unequal experience the leader's responsibility is greater, and his direction has to be the more formally and unquestioningly accepted. A child has to learn to take his elders' 'yes' or 'no' as final in the crisis of some new experience: there is often no time to give him reasons, and his experience would be insufficient to enable him to convert them into the immediate action required. But it is more difficult for a man, possibly with a brilliant record behind him upon British rocks, to accept a decision unquestioningly, especially if he has been accustomed in moments of crisis to depend upon his own skill or judgment. To delay, however, or to argue is as fatal as to disobey. The leader may be wrong, but his error will probably be on the side of over-caution, since he will be consciously directing for a party that has not yet learned to work together. To prove him wrong, by the successful issue of our disobedience or disagreement, is as destructive of the future harmony and activity of the party as to prove him right, by its ill-success, may be to the actual safety of the party at the moment. A good-tempered party of beginners, with a mild leader, may continue to climb together on these undefined terms, but there will be hesitation and consultation where there should be decisive action; it will never grow fit for any serious expedition. A leader of greater experience or shorter temper will clear matters up at once. He will know that though his judgment may not be infallible, the fact that it may be questioned at a moment of crisis must be dangerous. A mountaineering party has to establish a habit of friendly discipline. Most young men when first taken out to the Alps have had experience of this discipline in other pursuits; but in moments

of excitement the national spirit of independence, or the instinct of self-preservation, is apt to assert itself, and these moments, if they occur before the party is welded into a climbing unit, may be fatal to its constitution. A wise leader will insist on a reasonable discipline or suggest a dissolution as the lesser evil.

If it is the duty of the young mountaineer to learn to accept a constitutional authority for the good of his party, it is that of the leader or manager to see that it is used only for the good of the party, and to make it personally the less obvious, the more it grows to be accepted in understanding.

An early alpine tradition, historically traceable to the isolated and responsible position of the first guideless parties, who had to face the dangers of the mountains, still unfamiliar, and the army of their hostile critics as if going forth against an enemy, made the leader an absolute autocrat, the commander of a forlorn hope. Many leaders of this type were frankly bullies, ordering their friends for their good like old-time schoolmasters. Occasionally, when one man was marked out by experience or personality, the results were effective in climbing. But the tyranny would not now be considered tolerable, and under modern conditions it would constitute bad leadership. Knowledge of the craft is far more widely spread, and the climbing attempted is of a standard that demands an equal share of responsible work from us all. It is now recognized that the strength of a party lies in its collective capacity, not in its leader as one outstanding exponent. But the tradition still survives, and some oppressed parties will still awaken in the casual climber a wonder at the large amount of hectoring they will endure from their leader compared with the little which his methods enable them to achieve.

Management in Anticipation

Three things only are necessary for the salvation of a mountaineering holiday: good health, good fellowship and good climbing. These three conditions are mutually contributory and interdependent; and the last, the declared object of the association, is only attainable when the other two are secure.

It goes without saying that a good leader must be

able to design and direct an ascent so far as the actual climbing is concerned ; but he will discount beforehand half his chances of successful performance unless he has learned how to bring his party on to the glacier, at four in the morning, fit in health and on good terms with themselves and one another.

Physical Well-being.

Fortunately, in dealing with healthy men, special attention to the first condition of health is confined to the first two or three days of a tour. After these are safely passed, air and exercise and increasing general fitness take over medical charge and deal summarily with the beginnings of any lesser or local ailments.

There is no need to bother overmuch about the party before the tour commences. Of course men, for their own sakes, will come as fit as they can. Attention to the diet and, if it can be got, some regular exercise in the open air—walking, running or tennis—may be suggested ; but I have never seen any particular benefit accrue from exercising particular sets of climbing muscles. I return to this elsewhere ; and I would only make one exception here, for a leader's attention. Some men, especially as they get on in years, are liable to cramp in the trunk muscles from the fatigue of general climbing, and in the hands after severe rock-work. In these cases it is well worth while recommending anticipatory 'local' exercises for the hand and forearm and for the walls of the trunk, to keep the muscles supple and 'long.' Dancing, skipping, fencing and wood-chopping are all worth mentioning to men who cannot get into the open air. And, above all, the morning cold bath !

The first few days of the tour, however, are vital. Mountaineers are sound men, and have usually only two weak points, the feet and the stomach. New boots or overwork attack the first ; unaccustomed food, changing atmospheric pressures, and revolutionary hours of sleep, food and exercise upset the second. For the feet precautionary measures are the safest. In ordinary life we accept their constant service unconsciously, and it requires an effort to give our own and, even more, other men's feet the additional attention they require on the first few days of any tour. To see that the boots fit, on the second day even more than on the first ; to make sure that one or even two extra pairs of socks

are put on if any boot has become stretched after wetting; to discover if there is any beginning of rub or blister, and to check it by boracic powder or other ointment in the sock at once, even if this means a halt in the middle of a climb; to suggest bracing with cold water in the evenings or whenever opportunity offers; in the case of anyone whose skin is tender, to double these precautions: these are some of the first duties of management.

Internal chill is a constant risk during the first few days of exposure to unaccustomed changes of temperature. Damp clothes next to the skin are principally to be avoided. A spare vest, flannel shirt or 'woolly' should always be taken in the sack, for a change at hut or bivouac, even if the other clothes have to be worn wet or slept in. In a hut it is preferable to take the wet clothes off and to sleep rolled in a blanket, even though that may be also damp. During the day it is unwise to sit on damp or cold rocks. A coil of rope may be used as a seat, or a useful habit is to carry a small square of waterproof, in which the spare shirt can also be wrapped. When nearing the 'gîte' or hut, it is well to reverse the usual practice, and go slow for the last twenty minutes, so that the perspiration may dry gradually from the body while in motion, and not after it is at rest. By the fire in the evening, during the snooze on the summit, and especially in an enforced bivouac, the stomach is the vital point to protect. In case we get benighted, any spare clothes, or even paper, should be wrapped round the stomach. The coat should be taken off and fastened round the shoulders outside the arms, so as to concentrate all the body's warmth within it. The feet can be put in a rucksack. If possible, the boots should be kept on, to avoid their freezing hard. If they have to come off so as to save the feet from frost-bite, they should be sat upon, to keep them soft. Wind is another enemy to guard against while resting during the day or sleeping out, and a light wind-cloak is a sound protection.[1]

On returning to the hotel, a hot bath, if procurable, or a hot sponge-down, should always be taken; it not only clears the pores and supples the muscles, but it restores the normal circulation and removes congestion, due to great exertion and changing temperatures, which

[1] See "Equipment," pp. 82 and 86.

often produces a general feeling of discomfort, especially in the head.

Food.

Care in the choice of food, discouragement of the inclination to starve during the day and to overeat in the evenings, insistence upon a regimen to get the subconscious stomach working by its new time-table, and, in case of failure, the employment of the simple domestic remedies at once and in time, these are all indispensable during the first days. But their observance cannot be left without prompting to the individual discretion. Especially is this the case in looking after young mountaineers, who are unacquainted with the treacherous dealings of odd meals and broken sleep at high altitudes.

In the matter of the choice of food the leader has to overcome the repugnance natural after a satisfying evening meal to attend himself to all the rather messy details of provisioning for the next day.

No guide or hotel-keeper can be trusted to do this. During the first days of hard exercise the average man will eat but little solid food, and turns from meats and tins such as hotels love to load into the sacks. He has to be tempted with sweet-stuffs, jams (the small tins are irresistible), chocolate, and meat-essences and eggs for support. The disposition to eat little during the effort of the first days, and to eat largely in the reaction of the evenings, has to be countermined by the offer, at not infrequent intervals, of pleasant luxuries that go down easily. It is old-fashioned and entirely wrong, especially with young people, to give them only what used to be termed wholesome, nourishing food. In healthy open-air conditions the body knows what it wants, and the palate interprets the desire. Food that is not palatable or eaten with pleasure is of little benefit, and cloying sugar compounds, the best muscle fuel, become again surprisingly attractive.

After the new regimen has become a habit the air and the exercise will make almost any food welcome, and at any time ; but even then the secret of vigour is still plenty of sweet-stuffs. One of the small matters that contribute almost absurdly to maintaining the good spirits even of a trained party is the production at suitable or surprising moments of small indulgences—chocolate, raisins, preserved fruit, honey or sweet-

meats. They weigh little, but the body's appreciation of and response to differences of food is exceedingly fine when it is making great exertions, and their immediate effect upon muscle and spirit is as rapid as that of stimulants in ordinary life. A whole summer tour in a bad season of soft snow has been lightened by a large bag of acid drops reappearing each day at weary moments with a new delight. In the plains I am myself a small and careless eater. But among my mountaineering memories days of fierce sun-glare on interminable white passes still remain rosy with the recollection of 'a raspberry-jam snow' or golden with the cool glow of a tin of yellow plums scooped up with ice-splinters.

Good management will consider no such detail of provisioning too small for attention. And it is not sufficient to order: each bag or packet should be opened, to see that the order has been fully executed, before the sacks are packed.

Thirst.

Thirst is another difficulty at the beginning of a tour. To a large extent such thirst is merely feverish; it is impossible of satisfaction, and to indulge it swamps and upsets the human machinery. Some resolute men, to avoid the delicious temptation, train themselves not to drink at all during the day; and then make it up in the evening. But a certain amount of liquid is as essential, in action, as a certain amount of food, and the moderate habit has to be acquired by practice. The exact amount necessary, as distinguished from acceptable, varies with the individual. The merely feverish thirst of the first day can be dodged by letting water run through the mouth, swallowing, as a special indulgence, only a mouthful or so. Sucking a prune-stone, or even a pebble, keeps the saliva flowing and is a consolation on hot snowy tramps. To the same end, of prolonging the pleasant assuaging process, devices such as sipping water slowly from a pearl-shell or cup cool to the eye, chewing orange peel, sucking a lemon or tea or wine slowly through lumps of sugar, or crushing a handful of snow till it becomes an ice-pear in the hand and then sucking the end of it, are all worth remembering.

Meat-fed men do not require strong stimulants. A little wine in the water, chilled by snow, is often pleasanter to the taste than water alone. Mountain

water has often a flat flavour of cold stones, or recalls the flask or pouch in which it has been carried. Wine removes this suspicion. Spirits should be kept for a last resource, for cases of injury or collapse, and then used only if the head is not affected. Their stimulus, under the conditions of climbing, is too evanescent to be of any service; the reaction is almost immediate, and the resulting condition worse than before. Cold tea and cold coffee are popular beverages: or the juice of many lemons can be carried in a small aluminium flask, to mix with the chosen blend. Sugar lessens the quenching power. If sugar cannot be dispensed with, a lemon squeezed into the tea restores its effect upon the saliva-ducts of the mouth. Snow, crushed ice or water can be added as the supply diminishes.

The danger of drinking snow water is, in my view, a superstition disproved by experience. Its supposed ill effects are usually to be traced to the amount of cold liquid actually consumed rather than to its character.

Some men prefer to take their liquid in the form of snow sprinkled over any food they eat. This is an excellent way of making food of all kinds palatable in the early stages of a tour, while the disinclination for solid food lasts.

A device that never fails to entice even the youngest mountaineer past the clogged-up 'can't eat' phase of early training, is to make a small hollow in the snow, empty a jam-tin into it, and mix the jam with loose snow into a fruit ice. In colour, flavour and immediate effect it is one of the few undisputed additions that the ingenuity of man has been able to make to the charms of the mountains.

A good manager should never fail to remark a man who is constantly stopping to drink at passing streams. Spartan example in abstinence will do much to check him, but if this fails, he must use his wits to substitute one of the devices mentioned, so as to save the man's interior without injuring his feelings by direct comment.

Smoking.

Smoking I believe to be a question for personal decision. I have never found the moderate indulgence in pipes or cigars affect wind or training in the slightest degree during the hardest days. The rule that halts should be few and short ensures moderation; for smoking during actual climbing

is all but impossible. One famous mountaineer prefers to light a pipe before any particularly hard problem, but experiment suggests that the art is not worth learning. It is uncomfortable for the lungs and costly in pipe-stems. A pipe makes a good temporary substitute for food, drink or sleep. It comforts many cold moments of waiting and makes a soothing counsellor in difficulties. Ability to smoke, and consequently to sustain his part in the effortless silence which characterizes the true comradeship of mountaineering, should be among the qualifications of any climbing companion.

A manager's functions are precautionary rather than corrective. It is well that he should know something of medical treatment and of first aid. But advice under these headings is best obtained from the many good handbooks. From them he will learn how to use the contents of the pocket medical and surgical cases without which no party should ever attempt to climb.

Ailments.

Without trespassing upon their special province, there are yet certain practical observations and precautions which a manager should make and take as part of his routine.

The readiness or unreadiness for food, and the disposition to drink or abstain between halts, are useful indications of the extent to which a party is coming into condition, and a leader must observe them and take them into account in his choice and conduct of the next climb. The desire to drink early in the morning is a sure sign that a man is slightly 'feverish,' or that he has not slept well, and his condition must be mentally noted. A sudden inclination to sleep at odd moments usually means that the nerves are exhausted by some shock or by over-long strain. The desire to sleep should be indulged, and a condition of lower vitality must be temporarily allowed for. The slight trembling of the knee in the tension of climbing that often recurs at the beginning of a tour is, of course, only a purely muscular sign that the leg muscles are out of training. It will pass in the first few days, but it cannot afford to be entirely neglected. While he is liable to it no man should be allowed to lead a difficult passage. Many men suffer at first from violent headaches above a certain height, often with giddiness and an inclination to 'mountain'

sickness. This occurs more particularly on snow; usually it passes off after the first few days, as the changes of altitude become customary. In these cases, during the initial period, constant supervision is needed in the matter of food, of bodily regimen, and above all of pace. Easy going is the best precautionary treatment. Wet handkerchiefs round the head, and bending forward whilst walking, so as to ease the heart's action, often afford partial relief; to cough, or hold the breath, gives a momentary respite. Rests are of little use, and often increase the pain. The attack should cease at the particular lower level which suits the individual circulation. If it persists, a hot bath will cure it for the night.

Half the sickness that so often spoils climbing or camping parties during the first few days is due to an interrupted or irregular habit of the body, such as is imposed by the new topsy-turvy time-table and the unfavouring conditions of living. A leader must let no reserve stand in his way, especially with young climbers, in warning against this risk or in securing its immediate correction.

Frost-bite is an insidious enemy: it attacks young people of weak circulation without any warning of pain and at very short notice. Inexperience treats it as just a passing numbness and not worth mentioning. I have known only one hour's walking over cold autumn snow, on the way up to a hut in the evening, to take all life out of a hand; and it took us another hour's hard rubbing to restore the circulation. There should always be spare gloves and socks in all of the sacks; and, until he knows his men, a manager should insist upon instant notice of a finger or toe that has 'no feeling in it.' Immediate and continued friction with snow or brandy is the remedy; but it must be applied at once. The limb affected should be lifted and kept up. Fires and warm rooms should be avoided. When fingers or toes have once been, if only partially, touched, they are more liable to a return. Extra socks and gloves should then always be worn. A mitten, with or without a glove, is of comfort where the climbing is too difficult to permit of the use of 'fingerless' snow-gloves.

Cold is not only a danger as it produces local chills or frost-bite, it also has an immediate deleterious effect upon the general climbing power and confidence. Wind, in

this respect also, is the greatest enemy of the climber. The muscles generate their own warmth, which is the body's energy; but once they get chilled from outside by wind or cold, they lose a great part of their power. A cold limb should at once be rubbed; and, as a precaution, clothes should always err on the side of being too thick rather than too light. The human body can endure great windless cold, but little cold wind. With the chilling of the muscles the nerve and will-power diminish also. For the reactions of cold, local and general, a leader must be always on the watch.

The sun has three dangers for inexperience. Snow-blindness rarely gives warning. It is often only painfully realized on the following day. Therefore until a man knows the power of his eyes he should use precaution and put on coloured or smoked glasses when he sees the first flash from the prisms on glacier or snowfield. But on rock coloured glasses are a great nuisance, where they are rarely needed however strong the glare. Again, in traversing snow-covered glacier such glasses are frequently an interruption to the observation of hidden crevasses. Further, experience suggests that as many as a quarter of those now climbing really require no protection at all. For others it would be sufficient to have their eyes blackened round with burnt cork. For others again it would be enough protection to wear clear glasses over eyes so blackened. Experiment alone will find our individual equation, and, unfortunately, the experiment may often be trying. But it is one well worth making, on suitable occasions, for the sake of the permanent gain if we find that glasses can be dispensed with. If a man who finds he needs glasses has forgotten or lost them, a mask should be made of any piece of paper, with the smallest possible slits for the eyes. He should also blacken round his eyes with cork. If only a single glass is broken, a paper or card, with a minute hole, should be inserted in the empty frame.

Sun-blistering is as permanent and excruciating in its consequences as it is gradual in its attack. It may be produced by the direct sun-rays; more severely by light reflected from snow or water or diffused through thick mist; less severely by wind and reflected light from rock or road. Grease is generally useless as protection; colour salves, as elsewhere recommended, are the only

preventive. It is to be noted that the facets of the face most exposed to the reflection from the snow, the underside of the nose, the lips and the cheeks, are usually given an insufficient allowance. Bathing in cold water is deadly, especially to the lips, once the skin has scorched. One compensation for the loss of our complexion with advancing years is the lessening of our susceptibility to this infliction.

Sunstroke in a mild form is constantly mistaken for mountain sickness, for "poisoning at the hotel," and so on. The surest precaution is to wear a loose handkerchief hanging from the hat, to protect the neck. The coat-collar can also be turned up. It is excellent, on all sun-glaring days, to make a habit of filling the hollow in the crown of the hat with snow, and, when it melts and trickles refreshingly down, of renewing the snow. Until men have got accustomed to being alternately baked and frozen three times a day, they have to be reminded of these and similar small precautions. In the event of slight sun-touches, ice or wet cloths, shade, light food, and no alcohol are the local treatment. Plenty of moisture outside and inside is essential, and, as for all other ailments, rest.

Bathing.

Bathing in lake or stream, or even in glacier pools, is one of the most perfect rewards of mountaineering effort. In the very early morning or at a night-start it is not advisable, as it checks the necessary business of getting the bodily machinery working; nor is it often desired at these hours. During the day, the inclination at great heights fortunately appears to diminish, coincident with the disappearance of the opportunities to indulge it. When the human machine is centring all its powers on the continuance of a single exceptional effort, it has an instinctive shrinking from submitting itself to processes, however delightful, that will interfere with this concentration. Rest is a necessary interruption and must be suffered, but short exposures of the body to hot sunlight upon cold rocks, or in colder water, in most cases do us more harm by producing a general relaxation than they benefit us by their momentary refreshment. But when the main effort of the day is past, and the body has no fear of calling out its last reserves, the bathe on the descent is an indescribable delight and refreshment.

We may have still some way to go, but to perform this we shall have, in any case, to summon up our energies afresh; and at such natural moments of interruption the bracing impetus of a bathe will help to regulate our circulation anew and to store mind and nerves with new energy for the new commencement. We climb for pleasure; and when body and mind are working in harmony the pleasures our mind suggests are generally the remedies or relaxations our body needs. If no water is to be found, to get rid of the stuffiness of alpine clothes, and to give all the skin surfaces a bath of air and sunlight, is only one degree less pleasant or stimulating than a bathe in water itself. Caution at the same time is necessary in encouraging men, and especially young people, of whose circulation or heart we may have doubts, to risk the intensely cold shock of glacier water upon baked and sun-congested surfaces. It is perhaps worth remembering that the risk of actual chill is greater during the process of drying in cold air or wind after a bathe (always a lengthy process in the towel-less Alps) than during the bathe itself. It is unpleasant for the time, but far warmer in feel and after effect, to put on clothes without waiting to get dry.

Minute attention to such details of provisioning, health, and regimen can be relaxed as a party of men comes into training and begins to know its business, but it should never be entirely discontinued. One day's carelessness in revising the food, or the disregard of a cold toe, a blister, or a 'bad night,' may at any time upset the plans of a whole tour.

In the management of boys and girls below twenty-two or so, it is impossible to exercise too much care.

Young Folk. Boys especially, whose activity depends upon the impulse of their interest and rarely settles to an automatic rhythm, may 'shut up' with startling suddenness, both mentally and physically. Nor can our observation tell us for certain beforehand when they are really beginning to draw upon their reserves of vitality, or when they are only getting bored. They have no conception of economy in their movement, so long as the impulse of excitement lasts. As the interest of a climb diminishes, on the evening tramp or the prolonged snow slope, their mental vivacity may die down, and with it ends their energy. At such

times, if they have not been allowed actually to exhaust their physical strength, they will revive as rapidly in response to a new mental stimulus, of talk, or sight, or varied exertion. In their case it is the mind that calls for first attention and first aid.

Girls move less on springs and more by rhythm. Their activity is less reflective of external stimulus, and less dependent upon mental impulse for its continuance. They have not the boy's natural armour of nervous sensibility against overwork. It is, therefore, more possible in their case to watch the degree of positive physical fatigue in outward signs, and to anticipate more exactly the moment of exhaustion by suitable measures. Though their endurance is on the whole greater than that of boys, or at least fluctuates less in proportion to the amount of mental distraction or interest present in the physical effort, the effects of over-fatigue are more lasting. With both boys and girls, the only safe precaution is to allow very broad margins of time and distance, to select climbs which both in difficulty and length shall be well within the powers of young growing bodies, and above all not to be induced by the suppleness of youth or its momentary enthusiasm to make exceptions 'just this once' to sound general rules.

The influence of the mind upon the body has its special concern for mountaineering management. An athletic body, if it be nervously constituted, may be as susceptible of fatigue after two hours' walking on a dull road as after twelve hours on an exciting ascent. Mental distraction is as important as change of movement for the easy performance of sustained physical effort. Mountaineering owes for this reason to its infinite variety of motion and interest a record of feats of sheer endurance such as no other human pursuit or sport has excelled. But not all mountaineers are conscious of their debt to this peculiar virtue of the hills, or allow sufficiently for its full enjoyment in making their plans. Far more than any muscular strength or even physical fitness, will-power is the dominant force in maintaining normal energy and in subduing abnormal *accidiæ*, to which reference is made later. The leader is most efficient who can best protect his party against influences that irritate the nerves and so interfere with the power or

Preventable Humours.

desire to bring the will into play. Men bored, men irritated, men disappointed, men overwrought, without pleasure in retrospect or prospect to refresh them, lose the wish to throw off their mood. It is against the causes of boredom, the effects of exaltation or of disappointment, that the leader has to take his precautions. If, in spite of him, the moods are created, he must be ready, in anticipation, to provide some remedy of distraction that can release the will from the oppression of the nerves and associate it in the effort to master the mood. External distractions are the most effective. The alarm of fire has been known to banish rheumatism or paralysis; the sound of an avalanche electrifies a twisted ankle into painless activity; the sight of the hotel round the corner cures exhaustion like a cold douche; an ingenious conversational opening will carry a limping band over unconscious miles of extra effort. Anything that for the moment can release the consciousness from its overmastering nervous affection, nervous in effect however physical in origin, enables the will to recover control of the muscles. These external provocations excite states of anger, interest or alarm wholly different in character and effect from passive states of irritation and obstinacy which are produced by the reaction from an internal consciousness of fatigue. A leader will welcome them, in fact, as antidotes to their apparently kindred humours.

Boredom.

It may be assumed that a modern leader will not make the elementary, although traditional, blunder of taking beginners or young people or women for their first expedition upon the weariness of snow trudges, such as the traditional first tour up the Zermatt Breithorn. But even with an expert party he has to remember that boredom is one of his chief enemies. Monotonous snow slopes, long moraines before dawn, long zigzags on the path when the excitement of the day is over, make an undue call upon the will, such as suggests fatigue to the mind before the muscles are really exhausted. They are part of the day's work, but they put a strain upon the temper of an untrained party that is more wisely avoided.

With the same danger in view, a leader, while he insists on early starts, should not give his party too much to do before daylight. Men without guides lose

endless time, energy, and, worse still, temper and tone in losing their way and their footing on the preliminary paths and glaciers in the dark. It is better to start an hour later, and recover half of it from the easier, surer going of daylight progress. But best of all for a guideless party is to reach the inn, hut or bivouac in sufficient time the evening before to allow them to make thoroughly sure of their next morning's dark exit from the mazy streets and fields, or of the easy route on to and through the nearer glacier. Men are irritable enough in the dark, and if they cannot get going at once to a sure rhythm on a certain route, their harmony of movement and mood may be impaired for half or all of a day. Of the means of meeting the special boredom peculiar to snow tramps, something is said under Snow Craft.[1]

Over-excitement.

During the early days of a tour, on the other hand, there is always the contrary possibility to guard against, that the mere excitement and novel sensation of meeting difficulty may urge men beyond their strength and conceal from them that the limit of their endurance is already crossed. When the nervous tension is over, physical exhaustion sets in very suddenly. The situation is awkward to deal with; but physical crises are definite and yield to definite remedies. The sympathy and efforts of the whole party are at once concentrated upon the victim. Fatigue is lost sight of in the greater common need and the supreme effort for which it calls. The individual may suffer, but the tone of the party, if anything, profits. The leader may take comfort in this thought, and also in the fact that even if a climb turns out unforeseenly sensational, it has none the less to be carried through, and that there is some cause for his gratitude if undue excitement will help to sustain a weaker member of his party over the serious part of the day, even at the expense of an off-day on the morrow.

The effects of fatigue from mental suggestion or boredom upon temper, will and, ultimately, energy are less preventable. They tend to divide a party socially and to make them irritable, carelessly reckless, or obstinately languid. Mental tonics, distractions and talk are less easily administered than helping hands. But a leader,

[1] See "Snow Craft," p. 332.

whatever his own state, has to pull himself together to anticipate or to meet the occasion, and use all his tact to distract attention and create a new interest in anything but the individual consciousness of fatigue.

Leadership in Action

The manager as leader has a special responsibility to himself. He is the stroke of the party. Like a good stroke, while exerting himself to the utmost, he has always to keep some strength, nervous and physical, in reserve, to meet a sudden emergency or to vitalize unexpectedly depressing hours of dull return. As a duty to the party he should save himself by making use of the stronger members, should there be any, to take something of his share of the more laborious and less vital labour. A party which knows his value as reserve and management will save him, for instance, some part of his portion in the work of carrying, of leading in soft snow, or of easy step-cutting. They too must recognize he has always to keep something in reserve for a crisis.

The Collective Confidence.

At the same time, no matter what the crisis or his private doubts, he must never appear, if he can possibly help it, to have called out his last reserves, or to be feeling any diminished confidence in his own ability, or in that of his party, to force a successful issue. He must, too, avoid mystery. Nothing is more nerve-trying in critical moments, to men whose experience cannot measure the extent of a crisis, than tense silence or too obvious self-control on the part of those who can. It is better, if the situation is genuinely serious, to bring it down to a human level by blowing off a few words of violent commonplace expletive, than to leave it in that daunting remoteness of gravity for which words are inadequate. The more crucial the occasion, the more does the nerve of the party centre in the leader. Their confidence in his confidence is a more important asset than their confidence in his skill. The combined ability of a party, each one confident in the others and relieved of individual responsibility by his sense of the general confidence, goes further towards success in the solution of difficulties or the repulse of danger than the brilliant independent success

which any one individual in it could achieve by reliance on his single skill and nerve.

For this confidence the leader is the focus, and an important decision, such as the resolve to advance or retreat in a given crisis, should be guided by his estimate of the amount of confident capacity represented by the party at the moment, and not merely by his opinion as to his own power to force the passage as an individual.

If he decides to turn back on a climb, he should take the odium of the decision without fear of later criticism. He knew or felt what the collective ability of the party was at the time in relation to the effort demanded, and it is unimportant what an individual may afterwards think might have been his own chances of overcoming the particular difficulty "had he been allowed to try." If he continues the climb, with the same consciousness advising him, it must be his object to better the chances of success by stimulating the existing confidence into that cheerful humour in which men do their skill most justice.

Keeping Touch.

To keep in touch with every one of a party of friends, so as to continue aware of the way in which their minds and their bodies are being affected by the circumstances, is not easy. On severe climbs it is all but impossible to prevent the rear men, separated by lengths of rope and interruptions of difficult ground, from remaining in ignorance of what is being done in front, or of what is guiding the choice of problems which they are expected in their turn to surmount. For this reason it is helpful to break the habit of silence which falls upon men dealing with serious work,—and which, like the inclination to whisper in a dark room, seems to have behind it some primitive feeling of fear of provoking further attention from unseen but very present forces,—and talk down the rope occasionally, passing question and answer up and down, and cheering the tail with a renewed feeling of unity and confidence drawn from the confidence of the leader. With the same object in view, wherever the climb allows it, the party should be allowed to collect for a moment and forget in talk the depression or doubt inevitable to solitude, before the leaders start again.

Guides are great offenders in this respect. They

have no conception of the extra force given by a single united consciousness to a party, of the means to keep in touch with it, or of the help they themselves may draw from it. They climb absorbedly ahead lost in the sense of their own responsibility. Consequently they often turn back, from a doubt of their party or a lack of confidence to carry a climb through on their single responsibility, on occasions where a good amateur leader, with or without guides, can feel himself justified in proceeding. He is in a position to take the even chance of a turn of weather, of the possibility of a return at a later and more unpleasant stage, of the crossing of an exposed couloir or the ascent of a snow or ice slope down which there may be no safe return, because he is confident in his knowledge of the condition of his party, of their concerted action and reserves of strength and cheerfulness, and feels that these are sufficient to carry them over the possible chances of worse weather or more trying conditions, and to lead them through a longer day to a later descent even by another line.

He has to earn his right to his more confident decision in thus matching his men against the mountain by supplementing his single mountaineering experience and instinct firstly by his precautionary care for their condition and humour, and secondly by his ability to keep in close touch with their collective capacity at any and every moment. His reward will be their increasing confidence in themselves, in him, and in their united strength, and the increasing power which this brings with it.

Temper.

A mountaineering party, when in action, is dependent for its good-humoured and hearty co-operation on more than the external interests of the climbs, however well selected beforehand and sustained, on more even than its good health and food, however well cared for. It has to be welded into a fine instrument : its temper is its strength ; and its temper has to be kept at just the right heat. Hot words on occasions will do it little harm. Men in a state of primitive well-being are apt to become elemental in temper. A sudden crisis sets off a shower of sparks of language. These do no harm. No experienced man looks upon them as personally directed, or remembers

them when the crisis is past. What has really to be guarded against is the effect of monotony in any form, even the irritating repetition of some small unconscious personal trick. Slight resentments become magnified grotesquely during the long hours of silent effort, especially of monotonous effort, on snow, glaciers or path. Any ordinary mountaineer will probably remember occasions when some trifling habit of a good friend, some unintentional or momentary lack of consideration, has taken advantage of the dull ending of a strenuous day to come back upon him irresistibly, and fill him unaccountably with sullen growing resentment. He may realize its foolishness, but, like the similar insistence of the refrain of some silly comic song, it becomes part of the mechanical movement in which his whole being is for the time absorbed.

If he has been fortunate enough to escape such an attack himself, he must at times have been aware of the dangerous electricity accumulating in some one or other of the members of a tired party. It is the commonest symptom of fatigue. A manager has to look out for this. Its consciousness will disappear with the sight of the hotel door, and be secretly regretted on the morrow, but in the meantime he has to prevent the unforgettable being said. Silence is his chief enemy. It is useless to try and tempt tired men, usually tramping in single file, into agreeable conversation, unless some happy accident of the way rests the mind with a new distraction, but he has to seize any desperate occasion for casual remarks. It does not signify what he chatters, provided he is not inappropriately cheerful, and shows himself at least to be completely and seemingly idiotically unconscious of any strain in the situation. Even if he draws the discharge of temper on himself, he has averted all serious danger. Song is the best outlet since it fits in with the mechanical movement while it withdraws attention from it; but song can only be employed when the ground allows of the feet moving in accord. If he himself is one of the two between whom one of these smouldering irritations is getting ominously overcharged in the silence, he has a harder task. But he will have his reward if he can sacrifice his own humour to his sense of responsibility. There is nothing more refreshing to an irritated man who has succeeded, at last, in forcing

himself to make a suitably casual and unconscious remark, than to watch the visible efforts of his friend, suddenly deprived of his sure conviction that the resentment was mutually conscious, to pull himself hurriedly together and answer in the lighter key. Both men are so fully aware that their savage humour is ungrounded and absurd, that neither wishes to appear to be left alone in his folly.

Temper is the one permanent peril to all climbing parties, and it is never allowed for sufficiently, or openly treated in its true character as a largely physical phenomenon. Men who have to live long together at great heights, as in the Himalaya, or in great solitudes, as at sea, know that its outbreaks are practically uncontrollable, and many an expedition has failed on its account alone. It is best to treat it frankly as a necessary contingency, and to take the only two precautions possible: the one, to make sure that the men know one another well enough to accept each other's abusive outbursts as a sick mood, to be answered in like manner, if they will, but not to be remembered; and the other, to impress on them that it is the keen edge of silent resentment or sarcasm that leaves permanent scars, and that blunt abuse or invective, obviously uncontrolled, clears the air like an electric storm, and can be safely countered by retort as noisy and superficial.

It is superfluous, no doubt, to make these suggestions for what may be called the social conduct of a climbing tour. But friends, because they are good friends, are apt to reckon too little with the severe strain put upon comradeship by the circumstances of their mountain association. Personality is tried by the realities of mountaineering in deadly earnest: your good comrade in the hills is a very different man from your pleasant neighbour at the mountaineering dinner. And just as there is no comradeship that can grow so intimate or lasting as that of men who have climbed long together, and faced death, storm, fatigue, success and failure in company, so there is no compact which should be entered upon with more precaution, or protected with more sedulous care in the trifles of its daily routine.

Unless it be to men whom he is definitely initiating into the pursuit, a leader should not give advice or make direct suggestions; in fact, the less he fusses or appears to

be consciously setting the tone, the better. There is nobody so tiresome, in daily contact, as some one who is constantly being cheerful or tactful or managing. Example is the leader's medium for correction, in humour as in action.

He must see to it that no loophole is left for discord, in small arrangements as in small talk. For this reason it is helpful to let each man look after some department: one to see to the ropes, another to the drinks, and so on; but it is a mistake ever to remind a man of his duty to the party. Management is the leader's business in the end; and he should see to any omission himself rather than suggest forgetfulness by a criticism. Similarly, as an instance, in dealing with a foreign language, with a new hotel or with a new guide, the negotiation should be entrusted to one alone. He may be chaffed afterwards, but not interrupted at the time. It is feeble in effect and rather humiliating to see, as one often does, two or more sedate Englishmen effusively answering a head waiter in chorus, or treating any remark that has to be made in a foreign language, say to the guide, as an occasion for a collective assertion of individual capacity to speak with tongues and of equal right to use them in giving orders. Again, as a small instance of what I mean, there should be no question of comparing the weights of respective sacks before a climb. It is assumed that each man will carry what he can. If a man is a poor carrier and intentionally lightens his personal luggage, it is a blunder on all counts to ask him to carry more than he offers to take of the common provisions. It may seriously handicap him, and will certainly hurt his feelings. As an exception, however, since it is no reflection on his comradeship, a man who is found to be constantly carrying more than his share may be checked for his own physical good. There are a few men who by development and disposition are unhappy unless heavily weighted. They may be indulged, especially with the charge of the agreeable extra luxuries.

Once he has got his party started, fit and fed, and with no failure or dispute in arrangement or humour that may give room for later discomfort or irritation, the manager has to be especially on the watch for the different effects on his men of the hours before dawn and of the hours of evening return. The habit of talking

before sunrise should be tacitly discouraged. Most men are inclined to surliness in the early dark hours, which will disappear with the sun and improved circulation. Silence at this period is fraught with no dangers which the beginning of active climbing will not remove. During these early hours mind and nerves and muscles have got to rediscover their harmonious working for the exertions of the day. Their process of adjustment should not, therefore, be distracted.

In the morning mechanical action and the automatic reflexes have to be re-established, and the mind has to be induced to co-operate. In the evening, as has been shown, when mechanical action tends to degenerate into monotony, and muscular and nervous fatigue become master of the mind, an exactly contrary line of action in management is necessary, and the mind has to be helped to escape from the infection and to reassert its independence by intentional distraction.

Abnormal Moods.

But there are certain abnormal states, unforeseen but inevitable effects of the direct action of mountain incident upon nerve, harmony and energy, which on occasion must be met, and which should therefore be mentioned. Apart from preventable physical exhaustion, and the languor and ill-humour produced by boredom, there are several conditions of mind which may evilly affect the power of a party, and for varying lengths of time.

Reaction.

On the first splendid glow of success, when the difficult ascent has ended triumphantly on the summit, there follows a phase of complete relaxation, of surrender to the simple realization of rest and physical enjoyment. It is a period of indescribable sensations, of imagination run riot, and of will and self-control alike in abeyance.

When the subsequent descent is begun it is at first, for many men, a matter of real difficulty to recover complete control of their machinery, and for the leader to reconstitute the different individuals into a single working unit. For a time the pace must be diminished, and the care redoubled. Precautions, of remonstrance and doubled ropes and moving singly, none of them possibly necessary in the same place with the party in working order, must be put into force, until the normal condition is regained. The assumption that the state

of mind makes no difference, and that a party can descend as securely the final slopes that it raced up light-heartedly in the bracing moment of success, is all too commonly made, and only too frequently regretted.

If success has its short following period of danger, disappointment has a longer and more insidious effect.

Disappointment. However necessary or admittedly correct the decision to turn back may have been, the disappointment works afterwards, often unconsciously, upon each individual, as he realizes his wasted effort and envisages his fatigue, with now no excitement or bracing of hope to counteract it. So come discouragement, and careless treading, and a resentful attitude towards precautions and manœuvres which no longer have any triumphant object as their excuse. Any weakness in condition or humour will grow doubly apparent at such a time; and as the disappointment is equally present in all minds, it is impossible to pretend unconsciousness of it, and often vain to attempt to raise the atmosphere by a counterfeit of cheerfulness. Mental and social tonics are for the time alike useless. The condition has to be accepted as an indisputable lowering of tone, which in its effects will prejudice the physical capacity of the party in many subtle ways. Since in this one case he cannot check the evil influence at its source in the mind, the leader must employ every concrete mountaineering device to prevent its endangering the actual safety. He must bring out all his reserves of spirit and technique to keep the party concentrated on the momentary details of their descent, and redouble his own activities in order to anticipate or correct any slip or mistake that the lowered tone may induce. On such occasions he can look himself for no relaxation of effort or release from anxiety until the rope is off at last and the safe path regained, no matter how little conscious his party may like to show themselves individually of any depreciation in their skill or good-will.

Equally difficult to deal with, and far more frequent in its appearance, is the state of mind to which most mountaineers are subject—and guides also—

Over-confidence. who have accomplished a great climb successfully and are retracing the comparatively easy passages of the lower ridges, glaciers and tracks.

Conscious of their successful performance, confident in their skill and unwearied muscles, intoxicated by air and effort and fortune, they are unaware of fatigue, and the easier ground lulls their judgment into a condition of fatalistic confidence, almost of exaltation. Danger, obvious and immediate, has become familiar, and has been safely avoided; they can neglect its threat when it is not so present. They jump the bergschrund rather than look for the bridge; they chance the unseen rock foothold rather than lose time in using the doubled rope; they glissade the loose snow slope and scorn its possible avalanche; the rope hampers them, it is taken off; and recklessly self-reliant, a reliance that success has fooled them into thinking justified, they rush the risks of hidden crevasses on the glacier, of false steps or loose stones on the easy ridges, with an abandon that it will make them shudder the next day to recall. Even the lower zigzag path to the valley is a danger in such a condition of mind. Safe as Rotten Row for the sure foot, it has a dozen times proved a fatal trap for the stumble of fatigue or the careless swing of over-confidence. Few men can look back on a long mountaineering record without remembering some such evenings of mountain madness; and while they blush (let us hope) even in memory at their folly, they may wish they had had some cool leader to call them, grumbling, to their senses. For while reaction and disappointment reflect at once upon the vitality, lowering the tone and, like a flat liquor, offering little chance of reanimation, over-confidence is an effervescence, an overflow of spirits, which can be more easily regulated by apt manipulation. The leader must take control, sharply and steadily. He has little to fear from the effect of his interference upon a party in such spirits; any resentment will be temporary, and his own labour, of repressing and directing a surplus of energy, will be far less than in the cases where, as has been shown, he may have to provide a stimulus or even a substitute for its absence.

There is an insidious danger common to all these mental states. As one of a party working together, a leader must remember that he himself is subject to infection from a collective mood. He may consider that his confident action on occasion is entirely individual and calculated; or, again, he may be certain that his

resolution to retreat represents only his own unbiased judgment; and in either case he may be puzzled later to account for an obvious error. He must learn to allow for his 'atmospheric' error, the unconscious perversion of his saner judgment by some collective mood of his party. The risk is very subtle. A leader has no defence against it except to keep its possibility constantly in mind. He must acquire the habit of challenging, mentally, his own opinions of the moment, and of confronting them, detachedly, with the sternest of mountain precepts and rules of thumb. The habit will stand him in good stead in moments of more dangerous decision, of excitement, and, therefore of more probable collective infection. It will at least check him from joining, even in his most ecstatic moments, in an unroped glacier stampede or in a 'go-as-you-please' skelter down a buttress; it may save him some of the lasting regrets of the leader who afterwards recognizes that he has turned back prematurely; and it will certainly protect him on many long tramps from that curious infection, hours of united, unreasoning mountain gloom.

Hysteria.

From a fourth state, actual hysteria or hill-shock, a leader is presumably exempt. It occurs more frequently among mountains than anywhere else off the battlefield, since their conditions may put an excessive strain upon unaccustomed nerves. Old climbers are inoculated against most of its risks. If a type of danger has once been experienced, on any subsequent recurrence, even faintly resembling it in character, the consciousness flashes out at once to meet it, in all its possible reactions; the mind takes control of the nerve communications and blocks the way against any evil effects resulting from the sudden shock to the subconscious nervous system. Only an entirely unfamiliar form of danger or an unduly prolonged strain can rout the presence of mind of a tried climber. But it is well to remember that every man has his 'cracking point,' and that this is sooner reached in the case of an uneducated guide, however experienced, than in the person of an expert amateur, whose imagination will widen his experience.

It may originate in three ways. Firstly, from exhaustion, irritating brain and nerves until self-control is

lost and any slight shock may cause the hysteria to break out, either in the usual violent symptoms, or, more intimidating because less anticipated, in silent tears. Exhaustion, not fear, is the basis. If it has not been possible to anticipate the crisis by precautionary rest or distraction, immediate inaction and quiet reassurance, without remonstrance or contradiction, are the best assistance to recovery.

Or, secondly, it may result from sudden shock, the realization of completely unexpected danger in a placid moment before the mind has time to assert its control over its own group of spinal nerves. This is the moment of panic which is the terror of all who have the charge of collections of human beings, in a theatre or on shipboard. If the shock can be anticipated by even the briefest of introductions, if a collective instantaneous realization of the danger can only be prevented by any method of more gradual communication of the news, half the risk of panic ensuing is gone. For if only the mind has the chance to realize the meaning of the news before the physical shock to the group of subconscious nerves has time to react, it takes command; and the man begins to act, and even to overact, for his own benefit if for no wider audience, in accordance with his conception of suitable gentlemanly behaviour under the circumstances. In climbing, indeed, there is often no time for such a gradual introduction. But in climbing, wherever danger is not cumulative, and therefore gradual, in its approach, the peril is over and past almost as soon as the shock is felt: for instance, the rock has fallen—and missed the party; the slip has occurred—and not pulled them down. So much the leader has in his favour in meeting its after-effects of fear. The crisis being over, it is best, if possible, to pretend to ignore its existence altogether, and to find some reason for a halt and for continued inattention until the nerves have had time to settle down. If this fails, the incident should be cheerfully recalled and discussed until its idea has become familiar, and so harmless. It is useful to remember that no individual panic, and for that matter no form of extreme emotion, can long survive the bland disregard of its existence by some one else in the same circumstances. But if a repetition of the peril still threatens, as might be the case after a rock or snow avalanche, and

therefore immediate movement is desirable, the orders for action should be sharp and decided, but quite impersonal: they should neglect any individual more particularly affected, and apparently be addressed to the whole party. Personal attention only tends to increase the self-consciousness and the self-pity which, in the frightened man, will be militating against the recovery of his self-command.

The third and most difficult manifestation, that of hysterical obstinacy, may be the outcome of a long-continued state of nervousness or of, often, groundless fear, accumulating and indulged by self-compassion until it gets beyond control. The hysteria takes the form of a refusal to move up or down, and, without any violent symptoms, remains impervious to reason or direct remonstrance. A halt, and a deliberate disregard, emphasized by general talk about some unrelated matter, will often result in a gradual loosening of the tension, mental and muscular, and the beginnings of unwilling movement. Once the rigidity is past, the rope and quick and not too gentle impulse will do the rest. But if the situation does not allow of even so much delay, stronger measures are necessary. I have seen a guide use a startling slap on the cheek in an extreme case with good effect; or a jerk on the rope, that forces the victim to scramble to recover his own footing, may break the spell. In any case, if the leader is unfortunate enough to suffer such inconvenience with a beginner, he will be wise not to risk the like chance on a mountain a second time, in both their interests.

Vertigo.

What is called giddiness, the paralysing effect of sheer height, suddenly revealed, sometimes produces unexpectedly a similar condition of immobility. Fortunately, in this case it is not accompanied by the same objection to being moved into security by others.

Habit also will remove the inclination, sometimes felt on the edges of sheer walls or cliffs, to 'throw oneself over.' This is another of the symptoms of slight vertigo. In spite of its frequent and sensational appearance in narrative, the inclination would seem invariably to confine itself to remaining merely an inclination.

Giddiness, the inclination to fall and the impulse to throw oneself over, is the result of the inability of the

eye at the moment to obtain an assurance that the body is upright or in balance. When a child is learning to walk it tumbles all over the place. Then it learns to fix some point on a level with its eye, and it can retain its balance in walking just so long as it can keep its eyes moving towards this point more or less on a level plane. Gradually it learns to get the same assurance from some distant point on the floor ahead: its eye has been educated to reason from a diagonal as much as from a level glance; and the 'semicircular canal' has been taught to interpret the message, and convert it into automatic balance. As it moves forward it shifts the point ahead, unconsciously obtaining that the third side of the triangle thus formed by its glance shall always demonstrate that the other two sides, the line of the floor and the vertical line through its own centre of gravity, are forming an approximate right angle. Still later it learns to apply the same principle to uphill or downhill gradients, where the line of gravity makes, not a right angle, but an acute or obtuse angle with the visible surface. That is, it learns to take the constant line of its own centre of gravity as the base-line of its triangle and not the fickle flooring; and it still keeps in balance in movement by measuring the third side with its eye, in order to be assured that whatever angle its body in balance is making with the ground, be it uphill and acute, or downhill and obtuse, shall remain the same during its next movement.

Even as men we cannot be sure that we are upright, that is, in balance—for our muscles permit us a few degrees of sway either way from our line of gravity—unless we are somehow in contact with the visible surface at two successive points in the line of direction in which we are moving, be the contact maintained by the touch of our second foot, by the hand, or by the glance of our eye. Shut your eyes, stand on one foot, and you will have proof of this. Men accustomed only to walking on the level make a habit of selecting the rest-point for their eye some distance ahead. Consequently, when they find themselves on a steep hillside, where the fall of the ground below makes a wider angle with their line of gravity than their eye has been trained to estimate, their glance wanders helplessly, they lose their assurance of balance, and they become 'giddy' or feel that they 'must' fall over. But habit will correct

this. The climber soon learns to shorten his glance, to accept a reduced distance between his two requisite points of contact. The few inches of visible surface near his feet, be it only the edge of a rock ledge or the curve of a snow wall, projected against nothingness, will serve him, with practice, as sufficient rest-point for his eye, and give him the assurance that his body is upright and his balance secure.

Wherever, in climbing, the angle of the surface is so steep that even these few inches of margin for the eye's reassurance are lacking,—for instance, on a precipitous rock wall with only minute stances, or on an almost vertical ice slope,—then, by the nature of the case, the climber can use his hands; and from this second point of contact, through his fingers, the climber gets an even more concrete assurance of his balance than from the judgment of his eye. There are cases, however, where the hands cannot or should not be used, and where the eye is so far confused that it must divide its responsibility for the second point of contact with some other agent; and for this we learn to use the second foot. Take the case of traversing along the summit of a narrow rock ridge, or across a knife-edge of ice. The hands are useless, and the eyes, unable to remain focused upon the narrow edge, wander away into the depths. The inexpert man will get giddy, and will only save himself, on the rock, by crawling across on hands and knees, thus forcing from his hands the assurance that his eyes refuse; while on the ice he will get giddy and—not get across at all. But the expert can step across either, rapidly and securely. In the first place he learns to focus his eyes undeviatingly upon the thin edge ahead, or upon some fixed point on the same line with it beyond; and in the second place he learns, since an expert's eye is human and embraces a large field, to divide its balancing duty with his second foot. This foot, advanced in the direction of progress, provides a second rest-point for the assurance of balance quite good enough to complement the eye. He strides out rapidly, so as to shorten the doubtful interval while this foot is in the air, and for assurance in this doubtful interval he trusts again to his fixed glance. A blindfolded tight-rope walker balances on the same principle, only he obtains his assurance from two points of contact even nearer together, from one foot only just in advance

of the other, or even from one foot alone, the two requisite points being then represented by his toe and his heel. Loose-wire walkers, who apparently deprive themselves of all fixed points for their estimate, substitute the pole or the parasol in their hands. This their trained sense continues to adjust at such an inclination to the shifting but relatively fixed point of their feet as may always give their hand a second relatively fixed point of judgment by which they can estimate the angle that their body is making, at any instant of rest or motion, with the line of gravity; and its leverage enables them to correct this angle whenever hand plus foot give warning that the body has so far departed from the line as to be entering upon the 'forbidden degrees.'

The normal mountaineer, however, need never expect to have to do with less than two stable points of judgment, for foot and hand or eye, and these at least a few inches apart. It is entirely incorrect, therefore, for anyone to assume that, because he feels 'giddy' looking down from the top of a wall, he is disqualified from high mountaineering. Some degree of giddiness would be excusable in any mountaineer, however expert, who might be asked to look down off the edge of a sheer wall, where there was no handhold, no room to shift a foot forward or backward, and which was too vertical to afford any rest-point below for the eye. If he were asked to walk along the wall, he would probably do it cheerfully. In mountaineering, also, we may count upon handholds when the eye is obstructed or the assurance of a second foot denied us. We need only train our sense of balance to assure us of security upon a basis of narrowly spaced but still quite natural points of judgment. And in the process of learning we shall find that we lose all inclination to giddiness.

The Effect of Height.

There remains one state, of whose nature and origin we at present know very little. It is generally called the 'psychological' effect of height; which it almost certainly is not. It has none of the bodily symptoms of mountain sickness; and I know no remedy for it, mental or physical. It is simply that certain men above certain heights appear to lose some portion of their nervous energy. Training or habit seem powerless to restore it. They

become incapable of moving with the certainty or rhythm which are theirs at lower levels. You can watch the effects in tentative, slower movements, a visible effort in balancing, clumsiness with the rope, insecurity in steps, sometimes a vagueness or absence of mind, as if the vitality were running low. And yet the men will be most vigorous and competent mountaineers up to their limit of height. Liability to suffer from it appears to depend on no question of physique or of probabilities. As its result many fine climbers on lower hills never achieve marked success in the Alps, and many fine alpinists, including most guides, are failures, relatively, in the Himalaya. If we were to go high enough, we should probably find that every man has his limit of height, above which no training or habit would enable him to climb with his normal vigour or efficiency. But what concerns a leader in the Alps, or an explorer in higher ranges, is to discover which of his party is subject to it, and at what heights, and make his dispositions accordingly if he is planning an expedition or series of expeditions which will exceed this limit. Otherwise, just at those heights and in those situations where the greatest individual skill is called for and the least attention can be spared to others, he will find that the symptoms will begin to put in an unwelcome appearance. The mountaineer himself is rarely aware of his weakness; he probably explains it to himself as a touch of passing mountain sickness. It is only when he, or more probably his leader, notices that it recurs at the same height and that the symptoms are not physical or mental, but affect the mysterious half-way region that we must call 'nervous,' that the true cause suggests itself. A leader must watch every new member of his party, and if he finds that he has such a height limit, he must not take him above it, if the ascent is severe, or he must be prepared to give him much increased attention and shepherding until the limit is repassed on the descent.

Social Composition of the Party

The social and psychological conditions that regulate the relations of any collection of human beings associated for a common effort or pursuit are seldom taken sufficiently into account. The interaction of individual

temperaments in mountaineering and the reactions of common mood under the stress of elemental conditions or of great physical effort have, in consequence, seldom been allowed for in anticipatory organization or made a matter for previous agreement, or for the acceptance of precautionary control. When the crises have arisen, it has been often, consequently, too late for remedy or for the exclusion of the dissonant elements. This must be my excuse for sketching these superficial classifications of nervous and mental states that are as positive in their influence upon the success or harmony of a mountaineering holiday as the possession or lack of a developed trapezius major or a sound digestion. Explorers of experience sometimes recognize the importance of choosing men for temper and temperament as much as for physique, and make their arrangements with this in view, in practice if not in their printed records. Mountaineering is done under much the same conditions; but its temporary, holiday character leads us generally, as we sit at home in the comfort of pleasant prospect, to overlook in our arrangements the almost primitive conditions of temper, health and fierce struggle under which we shall be living during our mountain association.

A mountaineer, in the composition and management of his party, cannot afford to neglect the action of health and condition upon temper, or of temperament and mood upon achievement. He must select men, therefore, not by their promise of the plains, but by what he knows or concludes will be their conduct under the harder test of the heights. If he has to take anyone on chance, he must be on the watch from the first, and, if he finds he has made a mistake, content himself with a less ambitious programme. In big mountaineering no man has more than a momentary margin. In less exacting work no man has a continuous margin of will-power, nerve and temper, to say nothing of skill, for more than himself and one other. Every party of more than two should contain two men of tried nerve—that is, of an experience that has learned to control the effects of shock or of fatigue upon the nerves. Every party, for its own peace, should contain one expert rock climber and one reliable iceman. A good second-man, or 'backer-up,' and a weight-carrier are invaluable assets. These parts may, of course, be doubled in a single individual. The

ability to heal, or cook, or sing may be allowed to outweigh some minor defects—but not temper, clumsiness or a sluggish vitality.

A manager has also to remember that that party earns the best success which works with the most collective good-humour and good-will. With the object of maintaining the genial atmosphere that best resists local disturbances, mental or physical, one member of a party of three or four may well be either younger or less experienced than the rest. Rowing eights in training have discovered the merits of a mascot or protégé, whom the rest can look after and laugh with or at. No party of men or women can quarrel if there are children (not belonging to them) of their number. One considerably younger member of a party, or one younger in the sense that he or she is a novice to the work, and in so far is a child, gives the climbing group the pleasant sense of centring round some one as a common care. He is a permanent distraction. In moments of excitement, pleasure or fatigue, every member of such a party unconsciously puts himself first into the new-comer's attitude of mind, and speculates how the sensation will present itself to him. The process provides our individual consciousness with an external interest that diverts us from the oppression of absorption in ourselves.

In a holiday party of four, which is the best number for serious guideless climbing, enabling the break into the ideal pairs for rock climbing, and the safer combination for glaciers, one member may well be an 'infant' or beginner of this sort; but if such an element is included the 'breaking' must be confined to very safe passages. In a party of three, provided that two are thorough experts, and one of these possibly a first-class guide, and provided that no severe climbing is contemplated, maleficent psychic influences may be combated by the inclusion of our less responsible third. If serious work is in prospect, the third must be at least strong and efficient; in fact, in parties of less than four, considerations of skill or experience must always take precedence of purely social qualifications. In a party of two, for rock climbing, both must be, primarily, expert, and our social selection must be confined to this class. For glacier work any party of two, even

though, socially, they speak with the tongues of angels, must always be unsound. The popularity of the party of two as a rock climbing combination compels us continually to reconsider its suitability under new aspects. As a social companionship the association of two friends, equally expert, is ideal. The association of two friends, one of them less expert but equally competent to share in the responsibility for a joint decision, is quite defensible. But it must be remembered that any external feeling strong enough to interfere with the complete concentration of a leader upon his climbing reduces the efficiency of his normal standard and still more of his standard of the day. His feeling of a particular responsibility for an individual, other than his general responsibility to a party, may act as a dangerous distraction. A man, therefore, who climbs alone with a novice, a younger person or a pupil, towards whom he is in a position of personal trust, handicaps himself to an extent that should forbid him to attempt any but absolutely safe and elementary climbing. The usual risks, even of merely external chance, which he may take lightly for himself or for a second companion of equal discretion, he may not take for his charge ; and the cheerful consent of an inexperienced comrade to ' share ' in taking such a chance cannot be considered as relieving the single expert of any part of his exclusive responsibility. If he has the sense of it constantly in mind, the feeling turns to anxiety in moments of crisis, and interferes with his coolness of judgment and with the nervous harmony upon which his skill depends ; at more ordinary times its presence materially biases his ordinary mental and physical climbing habit. If, on the other hand, he undertakes such a charge, and then does not keep it in mind in all his decisions and actions, no one will consider him to have been a happy choice for the responsibility entrusted to him.

Where the sense of responsibility is further complicated by an emotional relationship its debilitating effect is increased. It is a commonplace of all active undertakings that relationship is irreconcilable with cool command and undisturbed performance. Similarly, a father climbing alone with his child or children, a husband climbing with his wife, cannot preserve the nervous concentration or the emotional detachment indispensable

for an unsupported leader. Whatever their normal ability as mountaineers, in such a companionship both their discretion and their execution must be subject to a hundred distracting influences. The disturbance, even the danger, of an emotional state in a member of a party has already been indicated. In these cases, however, it is the leader, whose business it should be to correct, who is the man affected; and, further, in a party of two so constituted, where the leader alone is morally or by nature responsible, no other can compensate for his abnormality or qualify the effects of his state or of his action. In my view no mountaineer should ever climb alone with anyone less competent for whom he must be held responsible either by relationship or by delegated authority; unless the climbing is so short and so safe that he can be sure of always safeguarding his charge against the ill consequence of any and every form of 'accident' however remote or unlikely. Practically this means that, except for simple 'bouldering' or elementary, separate 'pitch' climbs, without the addition of a second fully competent mountaineer all parties of this description are unsound.

In larger parties it is wise to give full value to social considerations in selecting the members, since we can always secure, by addition or subtraction, that any element of weakness introduced by relationship or private responsibility is balanced by a greater proportion of mountaineering skill. But for combinations of two our first business is to make absolutely certain that each man is equally competent, in his own and his friend's eyes even more than in the eyes of the world, to take his full share of *responsibility*. We may then, if we will, treat the separate contributions of skill as a collective whole, and not quarrel with an expert who takes a less expert companion, provided he be competent and responsible, if by so doing he secures a wider field for his social choice.

Walking Manners

There are several points of what may be termed walking manners, common to all types of long mountain walking and not only to climbing, whose observance contributes a great deal to the individual peace of mind

during the early and late hours of a long alpine day. Men when they are off the rope, or who have never been on a rope, almost universally neglect them, and are blind to the cumulative effect upon a tired companion's temper or upon their own humour. Every one thinks he can walk, and most men never bother to discover why the excellent companion of the Sunday afternoon ramble proved a failure on a long walking tour.

The first point of manners for the man in control is that of pace. Most climbers suffer from the weakness of increasing the pace the moment they take the lead on a path, slope or glacier. This is trying to the party, consciously or not, and wasteful. A manager should either block the way himself, or, if he is behind, keep consistently to what he considers the right tempo. It is better he should be thought to be getting old or lazy than that the party should be rushed inopportunely.

A second and frequent failing is the 'half step' trick. Some fifty per cent. of fast walkers, whenever they walk abreast on road or path or hill, persistently keep half a stride in front, their shoulder just clear of their companion. It may be due to some half-formed feeling of satisfaction in setting the pace and having a margin to turn round and talk from. Its effect is that the friend is perpetually straining to catch up, and the pace thus steadily accelerates till both are practically racing. Then one gives up, and both lag, until the game starts again. The habit is often unconscious, but it is extraordinarily irritating on a long tramp, or to a tired companion.

A third breach of manners, all too common, is passing ahead in the line of march. Over most broken country, glacier, snow or rough hillsides, men naturally fall into single file. Cattle tracks or man tracks are rarely wide enough for two abreast, and if it is a question of selecting a line, it saves reduplication of the effort to leave the task to one and to drop in behind him. There are few inexperienced walkers who do not take advantage of the slightest error in the choice of route on the first man's part, to break off and pass him on the shorter line. In doing so, they take the responsibility of taking all the rest who follow off the line also. On an ordinary hill walk, when the going is all free and easy, this is excusable,—no one is compelled to follow another

longer than suits him; as also in the case when the first man is obviously mistaken, and to cut his line is a distinct saving of effort for those who follow. But, done as by one of a line of men either tired or with a big day before them, where one has been taking the extra burden of route-selecting for the rest, it is a serious breach of mountain manners. The gain is probably only a yard or two, and the front man may justly resent having been left the labour of choosing the route at a hundred points, only to have advantage taken of his single doubtful choice in order to displace him. He either runs ahead to regain his place, and the rhythm of the party is broken in a silly competition none the less irritating that it is rarely acknowledged in words, or he plods behind with a slight sense of injury.

A more debatable occasion, where the same point comes into prominence, is on the ascent of steep slopes or open hillsides. An experienced front man will probably take these on a zigzag. To a less experienced walker, and to all beginners of energy and leg muscle, it is generally a temptation to cut the zigzags on the direct line, and so pass ahead. This is bad walking, but there is the more excuse for it in that on such slopes men rarely do follow each other exactly, and most of the party will probably be preferring each to take his zigzag at the most comfortable angle to himself. The best rule of manners to remember is that, while every man is free to choose any line and pace he likes on such places, yet, if one man has been definitely leading and choosing the line, the others ought to drop into their places in the line behind him again so soon as the single-file formation is resumed. It is more politic to be considered a well-mannered tramp than to assert one's powers as a limber hill-rusher.

Another blunder, from which many a good walker is not free, is the inclination to hurry the pace if the line or short-cut he has chosen takes the party for a while over worse ground, or proves, for other reasons, not to have been the best route. His almost unconscious acceleration is due to some impulse to get back quickly and unnoticed to good going, and so to slur over the mistake, or the momentary disagreeability of the route for which he is responsible, as much to himself as to those who follow. It is a trick to notice and avoid. It forces the rhythm

and pace over just the ground where it should, if anything, be eased. Men who walk much with parties which are afflicted with the 'racing' or 'passing' manias, are particularly liable, from a sort of nervous self-defence, to develop this failing also.

A leader must not walk carelessly or break the rhythm of step arbitrarily. The man who forces a plodding following to change feet unexpectedly does not know his business. Again, when walking in single file, or any way but comfortably abreast, men inexpert in acting as guides do not realize that although the man in front can hear all that is said behind him, yet that, unless he turns his head over his shoulder and throws his words out, he himself is inaudible down the line behind him. As the remarks from the leader on a long tramp, and when men are tired, have usually some direct bearing on the way, those behind him crowd up to hear; they break step, and are often put irritably on the strain. The complaint of many a young mountaineer, that his elder companion will never answer at all while walking, usually finds its explanation in the fact that the young man's energy carries him ahead, and as his remarks are addressed to the scenery, his companion prefers consistent silence and inattention to the strain of trying to hear, or to the irritation to himself and his friend of continually repeating, "What d'you say?" These matters may seem too slight to mention, but neglect of their observance brings many a party home with some member or other out of harmony and unappreciative of the sunset.

In the grumpy morning start or during the evening tired return it is for such details that the manager has to be most on the look out. He should, if possible, set the pace himself, and keep it without questioning or remark to what he judges to be the best pace of the laggard of the day. He should never let himself be pressed by some one at his heels, race ahead, or allow others to do so, except for some specified and universally beneficial reason (such as ordering tea ahead!), merely because the difficulties seem to be over and the way plain for the stronger members of his party. There is no pleasure in being left behind; it provokes a tired man and generally makes him obstinately slower.

It used to be said, and by the best authorities, that

with a tired or tramping party it is essential to keep the pace always the same, or they will lose the rhythm that alone can keep them going. This is a mistake. In the first place, variations in pace are a rest in themselves, provided that the actual effort put into each step does not vary. In the second place, it is definitely more fatiguing to be held back to a fixed pace on a sudden downhill gradient; and it is vexatious to pass from a long uphill grind on to a level stretch without the relief of a 'swing out.' Similarly, it is futile to change from a level to an uphill gradient and attempt to keep a party to the same rate. The mistaken teaching has been due to a confusion between actual rate of movement over the ground and the amount of effort required for each step.

Rhythm is essential to ensure good tramping, and to minimize fatigue. To secure rhythm the amount of effort put into each step, and not necessarily the pace, should be kept constant. Thus, in changing from uphill to level ground, the pace can be pleasantly quickened and the step lengthened, without any increase of effort in the stride or any change of rhythm. A longer stride is often a positive relief. In changing from level to uphill the length of the step shortens, since a lifting step is always more fatiguing, and the pace should be taken more slowly, though the output of effort is kept the same. On a change to a downhill gradient it is possible to change to a longer stride, or even a run, without altering the rhythm or increasing the amount of effort exacted of the muscles or of the lungs.

In resuming, after a halt, a frequent error is to start too fast. Young climbers, like young giants refreshed with wind, rush off at top pace. The re-start should always be slow—if anything slower than the average pace before the halt. Gradually, as the circulation and organs begin to readjust themselves to their work, the previous pace can be recovered. But a halt is definitely making reparation for the past, not accumulating a margin to waste in the immediate future.

When the energy of the party is running out, it is better to avoid halts altogether. To break the rhythm in such case and relax the mechanism is to make the resumption each time more difficult and the recovery of an equal rate afterwards very improbable.

To lead and choose the line is definitely more fatiguing

than to follow. To save strength and maintain pace, during a long day, the leader ought to be changed at regular intervals. This is too rarely done.

There are one or two further points connected with walking up or down hill which are matters of method rather than of manners, but which in so far as they affect the individual comfort react upon the peace of a party.

Some Notes on Hill Walking.

In walking uphill, the foot should always be placed so that the heel rests on the ground. It is a beginner's mistake to rush a hill and spring from the toes alone. If the flex of the ankle is stiff—men vary much in this respect—and the gradient is too steep to allow the heel to drop, look out for any little stone or excrescence, however small, to set it upon. If the path is very steep, and without stones, it is more comfortable to set the foot slightly sideways, so that the heel gets some support. This is often particularly useful at the turns of the interminable zigzags on alpine paths, where the track is apt to swoop up steeply round the bend. If the foot is thus placed slightly aslant at every turn, it is ready to advance at once after the bend in the direction of the new zag. A very slight economy, you may say: but multiply it by several thousand zags in a day!

Always take the outside and easiest line round such curves in ascending tracks.

The secret of all long grinds uphill is to set, and maintain, a regular pace that becomes rhythmic from the first. The moment you get behind a good hill walker, you will see the difference between his regular, restrained swing, more of the whole body than the leg, and the uneven jumping step, that seems each time to be a separate balancing effort, of the inexperienced walker.

Do not take long steps uphill, or lift the foot high. Raise it by slightly swaying the body across the firm leg and let the loose foot swing forward with its own weight. A good hill walker, of the 'tireless' variety, always moves with a slight balance or sway.

Always 'accept a slip.' That is, if the foot slips back on a loose surface, do not tire the muscles by a convulsive effort to stop it and to keep your balance. Let the foot go till it stops of itself as the topple of your

weight, out of balance, comes upon it; and then swing from that point with the other foot.

The effort you put into each step should be kept the same, whatever the change in the angle of the surface.

If you are leading and doubtful of your pace, try to sing. So long as you can sing or whistle two lines without panting or effort, you are keeping within your measure.

On a zigzag uphill, do not take the apparent short-cuts. They are made by men descending, and only waste strength and spoil rhythm.

On an open hillside, zigzag as if on a path, starting at the angle which lets you comfortably get the heels down. For a step or two, if there is no room to zag, you can walk with only the one heel down, and the other foot springing from the toe; but not for more.

If circumstances make it imperative to go fast, lean well forward over the feet, and as it were 'tumble up' the slope. This eases the work of the heart. If you have to race, and legs and breath begin to give out, make the hands do their share, and unashamedly pull the knees up to the stride by the breeches. You can thus keep a long uphill stride at a fast pace going long after the leg muscles, unaided, would have given out.

In descending take the shortest cuts you like. There are two weak points to look to: one the toes, and the other the muscles of the back, which do most of the balancing. The toes are protected by well-fitting boots and a well-placed foot. The back muscles are best indulged by letting the shoulders go loose, as you do when jog-trotting on horseback. This eases the effort of balance and the amount of holding back and taut that the muscles have to perform. It also diminishes the jar.

Except for grown men, of exceptionally strong ankles and knees, it is best not to plunge 'all-out' downhill, leaping straight-legged from heel to heel. The legs should be kept under control, and the feet pointed down and kept well under the body. The knees should be bent, tense, but not rigid; they will serve to take up all the jar, and act as springs. The step resembles a dancing pace, with a bent knee.

Do not be shy of using the arms and hands, on trees, rocks or scrub, to ease in any way the effort of balance

and the leg-strain during rapid descents. An ankle or sinew once wrenched is permanently weakened.

Long, hard road-tramping, with the leg swung straight, is not a good preparation for climbing. It jolts and stiffens the muscles, and fixes them in certain stereotyped movements. Good climbing guides are rarely good or fast road walkers. A long trudge often breaks them down and renders them unfit temporarily for severe climbing.

Standing about on the feet while the arms are being exercised merely tires the legs, and does not strengthen them. Many guides, who work hard at wood-chopping or in quarries during the winter, find their legs are all to pieces when the season begins. The knees are especially sensitive in this respect.

A climber's leg machinery is a delicate engine of educated springs and fine interactions. It can do a rough-and-tumble better than most, at need, but it should be guarded for its special and exacting work, and not battered or shaken out of gear unnecessarily.

Hill walking exercises and develops all the movements of foot, ankle, knee and trunk which we use in balance-climbing on rock or snow. It is the best training for the fine and precise motions that we need to educate. There is no doubt of the soundness of a man's climbing if he is seen to be a light and tireless hill walker. He may not necessarily be brilliant on rocks, but what he does he will do in good style.

If we wish to interest our young folk in climbing, the surest way is to let them walk and run loose by themselves upon the hills in early years. Rocks will meet them naturally, and if they are going to climb, they will begin to climb them naturally as they occur, with the feet and with the balance they have practised on their hill walks. To take them to rocks too early, as to a gymnasium, is to spoil their taste and deprive them of the chance of developing a personal enthusiasm and a natural style. Every good mountaineer must rediscover the hills and the passion for climbing them as of himself.

Choice of District

One consideration remains for the leader, if it has not been already decided by the preferences of his party—

that of the district he will choose for the season. A few general principles may help to guide his choice.

The tour may be either concentric, with ascents made from one or from a succession of centres, or eccentric, in which case the party will be moving forward and carrying its own luggage. The first is the more luxurious, the second the more attractive, holiday. The choice depends upon the character of the party and upon the weather of the season.

With beginners, in a good season, it is more instructive and independent to move along a range, crossing passes and taking only the climbs that come. The same progressive type of tour is the best to follow in a really bad season, when the big peaks are out of the question, for the time at least, and when there may yet be a delightful holiday spent in wandering among the lower Alps below the cloud-level. Even for those who may be ambitious of big peaks, this is a better alternative than sitting cooped up with other murmurers waiting for the impossible in high hotels.

On the other hand, in good but uncertain weather, if the party is desirous of big climbs, and has to economize its time, it is better to move by express routes from centre to centre, and to strike for the big peaks without loss of days, when the good weather comes, and while it lasts.

In more doubtful weather, when the days are playing at ' alternates ' but the peaks are still possible on fair days, and when consequently we are not forced down to the pleasures of low rambling, it is well to climb still from centres, and from the hotel itself. If, indeed, the party is aiming at a special peak, it should occupy the nearest hut, and provision it as a centre, ready to start on the first clear morning. But if, as is wiser in a bad season, it is wishful to take anything that offers, it is even better to stay at the central hotel below—since peaks enclosing a valley are often differently affected by different kinds of weather—and the party is then in a position to set out at once for whichever mass first becomes feasible. It can start overnight, and so avoid the hut altogether. The fatigue and romance of an all-night tramp are less prejudicial to the chances of a successful climb on the following day than the depression of a dull and stiff morning start after a comfortless night.

On the other hand, there is no more memorable experience than to sleep out in the open air during a spell of settled weather, with the stars for company and the first stir of wind before dawn as a strange awakening. The man who wishes to taste the full pleasure of a mountaineering day should sleep out whenever he can the night before, and he should lie far enough from his companions to be able to feel himself alone.

Possibly the pleasantest holiday of all is obtained by a combination of the concentric and eccentric methods, according as weather and inclination direct. To wander forward independent of times and plans, and to make pauses when we wish for more prolonged assaults upon peaks that tempt us, is a twofold delight. But it postulates leisure.

At home it is natural to base our calculations upon an estimate of a climb every day. Only when we are faced with the facts on the spot, the distances, portages and weather, do we recognize that we are lucky if we can make two or three good climbs a week. We must allow two days for each big climb, and leave a margin for the off-days. Younger heads or less experienced legs must be taught this last doctrine for their own good. The more practised will more easily recall that contrast is the essence of enjoyment, and that the days of hard going on ice and heated rocks are only fully realized and remembered if they are relieved by occasional lapses into tranquil lounging in the grassy valleys, amid the cool temptations of lemon-ices and clinking teetotal glasses.

If the party, having settled its general plan, has no preference for any particular district, it may be guided, in the Alps, by a few broad distinctions as between the best known districts.

The Oberland offers the best opportunities for snow and ice work of almost all kinds. For this reason the Oberland is often the best choice in a moderately fine or uncertain summer when the snow has stayed late. The snow slopes of the gentler Oberland peaks are climbable when the big ridges of the Pennines or the Mont Blanc region are still closed to us by snow cloaks and cornices. On the other hand, in a bad summer the weather is usually at its worst in the Oberland, and the long snow

wades may become intolerable, unless we are prepared to snatch a winter tour from a bad summer month by traversing the Oberland, with its high connecting glaciers and summits of easier angle, on ski.

Again, the comparative easiness of the ascents and the training they offer on ice and snow suggest the Oberland as a good choice for an introductory tour with beginners, and as an equally good choice for the preliminary week's training in any later season. There is no better introduction, or reintroduction, to alpine work than practice on the ice of the Aletsch glacier, varied by ascents of the snow and small rock peaks in the vicinity.

The Pennines offer finer individual peaks, with greater names, and they are more specially adapted for those who prefer concentric mountaineering, with bigger single efforts and the company of their kind. Their variety of type and aspect makes them suitable for selection in 'alternating' weather. Often when other regions are closed up, and when even its neighbours are shrouded, personal idiosyncrasies will keep some single Pennine peak open for quick, comfortable ascent. The merit of the Pennines is their mixed general climbing. They have fewer great ice and snow climbs to offer than the Oberland or Mont Blanc, and their rock is inferior to the Aiguilles.

The Pennines of the west, more especially the Val d'Evoléna, have the pleasant characteristic of offering short, condensed and possible climbs in bad seasons, when the bigger peaks are unapproachable, and when the Oberland may be indulging its habit of making bad weather worse. They, too, are an excellent introduction to mountaineering; but their miniature attractions have a somewhat dangerous fascination for British climbers, whom they are apt to hold spellbound even in good seasons, and withdraw from hardier and greater enterprise.

In a fair summer, the Chamonix Aiguilles are the flame-points on the crown of great rock climbing. For length, and as a test of skill, they have no equal in Europe. They also include some magnificent snow and ice ascents. But it is their rock that marks them out as supreme. As a consequence, many British climbers make the mistake of going to them too soon, before they

are equal to their demands. It is better to keep them as a great reward for labour when our developed mountaineering technique can enable us not only to overcome, but to enjoy the infinite variety of problems, and when we can feel not only participators in an ascent, but masters of ourselves and of the difficulties throughout their exceeding length. I have seen more than one of the most noted performers on British rocks and from the eastern Dolomites, men who could frolic up the Grépon crack, forced, from pure muscular fatigue, to ask for the rope before the Grépon summit was reached, and only rediscover the pleasure of the ascent of the Dru a full day after their return from the traverse.

To men who can get all that they want of difficult rock in our own islands, the Dolomites of the Eastern Alps present fewer attractions in sunny seasons. Their greater distance is a disability, and they offer small snow and ice practice. But in bad seasons they are an admirable last resort, and an escape to their warm, dry and coloured levels, or rather heights, may send many a party, disappointed elsewhere by ill weather of its alpine season, home in good health and firm muscle.

The great southern wall of the Alps, from Courmayeur to Macugnaga and farther, offers the greatest combined ice and rock mountaineering on the largest and most formidable scale. For those who know its secrets there is also the attraction of many smaller ascents, with the incomparable views as background. But it is not a region for bad weather, or for any but very competent parties.

Early in the season the Southern Alps, from Savoy and Cogne almost down to the Mediterranean, make an exquisite wandering-ground, all too little visited. In May and June we can often enjoy among them flowers, clear climbing and free wandering, long before their big northern brothers have shaken off their winter coats of snow and storm. They retain much of the undiscovered charm of the great Alps in earlier days, and a variety of beauty that can challenge comparison with the impressiveness of greater heights.

I have intentionally avoided mentioning those secluded and particular districts which it must be the fortune of all faithful mountaineers to discover for them-

selves, and where every enterprising party may gain the reward of its independence and experience in the certainty that it has found, at last and alone, the one perfect region, perfectly contrived, for all purposes of climbing and enjoyment.

Incidental Duties

Hut Usages.

Launched in his chosen region, and with his chosen comrades, the management of a leader has to observe, beyond his primary duty to his own party, one or two usages of an extraneous or incidental character.

If he is using huts, in the Alps or elsewhere, he should acquaint himself with the rules, written or not, of hut usage. Most will suggest themselves. To tidy up and leave everything in better order than he usually finds it. If other parties are in the hut, to keep the axes from cumbering the ground, and confine the wet clothes and wet boots to harmless corners. To arrange provisions and the rest the night before, so as to diminish the general confusion in starting by at least the quiet exit of his own party. To disturb sleepers as little as their customary assumption, that they are the only tired men who may, or will, ever use the hut again, will generally allow. Not to break open a hut or use any part of it for firewood except in desperate need; and to pay somewhere, or somehow, for any inevitable or accidental damage.

There is a further duty, which he owes to the position of his own party and to that of others also occupying the huts. If his party are merely guests, they are dependent upon the courtesy of other inhabitants for any treatment they receive more cordial in character than the sufferance usually extended to uninvited guests. But if, as every mountaineer in his chosen region should do, they have made themselves members of the local organization, he should insist, without demonstration, for the sake of sound hut tradition as well as for the improvement in the morals and manners of the other occupants (supposing they show themselves disobliging), upon the relations being those of courteous equality. As between his own and other amateur parties this insistence will rarely be needed; for the

tradition of comradeship among amateur climbers of all nations has seldom to be recalled by remonstrance. But as between his own guides and other guides, or other guides and his own guideless party, the footing sometimes calls for a prompt clearing away of the stones. Local guides are apt to take any advantage of a foreign or younger guide who appears. As is elsewhere described, the mental attitude of a guide in hut or hotel becomes generally that of the servant or dependent of his employer. He is no longer the free man on the hills, who will be himself the first to resent any incursion on the rights of his party. Once in the hut the amateur, in his turn, becomes responsible for looking after his guide. A guide's hut manners prevent him making any fuss, even though his own party's interests are suffering; as, for instance, when he is deprived of his precedence at the cooking-stove, or is left an unfair share of the collective washing-up. Like a swan on a new reach of a river, the young or stranger guide is very shy. He will often let himself be put upon by some parochial swaggerer or bullied by a lazy senior of his own valley. It is in our own interests, and the interests of the future, to protect him.

Apart from the local or obstreperous guide, the worst offenders against hut manners are not the guideless parties, who are usually anxious to do as they would be done by, but the chance 'professors,' and other cunning folk, who have discovered that alpine huts provide free summer lodging for themselves and their families, or the erratic solitary wanderers and grouped holiday trippers, who have never learned mountain manners. With these types decided action, or the decided appearance of passion, is sometimes the only course.

It is only courteous to use the hut books which are provided for entries; even though the sight of our own names and objectives in other company may offend our British habit of climbing hauteur, to which we ourselves give the titular rank of modesty. The information has a sentimental interest; it is required by the maintainers of the hut, and, further, it may be of real service if anything untoward happens and it becomes necessary to follow the traces of our party.

Outside the huts we have a duty also to the fragile

paths, which lead us to the glacier or the hut. They are easily depreciated by careless use, especially in wet weather, by breaking away the edges, kicking down boulders, slithering down inclines, etc.

Consideration.

Beyond the paths and the huts, there is a first law not to spoil the mountains: to leave no traces of meals on the summits or hillsides. Whoever discovers a portable contrivance for atomizing old bottles will confer an incalculable benefit upon conscientious mountaineers.

There is also an obligation not to spoil the mountains for others by heedless manners. This means not merely not to throw or kick stones on to other parties, or to pass them without their consent, which are matters that are regulated by positive mountaineering tradition, but also not to treat them 'negatively' when we meet them on the hills, as if we were all passers-by in the City at the luncheon-hour. I can call to mind still the annihilating stare of a lady whom I met on the top of the Weisshorn, because I ventured to remark about the weather without waiting for the introduction which there was no third party present in the vast panorama to perform; and again, two sterling Britons passing on a track in the highlands of Arcadia without greeting, because it transpired they did not feel that their slight degree of acquaintance was sufficient to cover a general conversation in which two other members of their parties, not similarly acquainted, would have had to be included! These are somewhat fine shades to preserve under primitive conditions, and foreigners are apt to misunderstand their respectable origin. It is better, on the whole, to be thought a cheerful idiot by our own countrymen if we hail their distant appearance on the chance of their belonging to a more sociable nationality, than to earn the reputation of racial surliness by allowing our shyness of what our own party may think to prevent us replying to the shouts of strangers of possibly more Gallic temperament. It costs little effort to make a cheerful remark to another party on the hills when we meet or pass them, and it saves an awkward restraint on both sides if we are fated to meet them afterwards again, in a hut or somewhere where we have to be together in harmony. In other countries we may safely imitate more demonstrative ways without loss of self-

respect. A courteous manner and a ready explanation will take the edge of offence off many a decided course of mountaineering action, that may run us for a while beside or across the way of other human beings. It might even be better if we could introduce into our chance encounters on our own hills something more of a superficial cordiality, so as to acquire the habit of conveying to strangers less obscurely the undoubted fellowship we feel with all other pilgrims of the mountains.

Of course every leader must acquaint himself with the code of rescue signals now recognized in the mountains, by waving or flashing or shouting. But he should further consider it as more than discourteous to refrain from replying to any shout directed at himself or his party. It is impossible for him to know by instinct what is merely the salute of high spirits and what may express some more urgent need. Similarly, if one member of a party gets separated from the rest, and is out of sight, it is not sufficient for him merely to guide himself back secretly by their shouts; he should reply to each of their calls, and so indicate that he is approaching. It is oddly irritating to keep shouting for an unseen man, realizing that his silence may mean that he is getting more and more astray, and then see him walk round the next rock, reproving by his silent proximity both our growing anxiety and our clamorous waste of breath. Our co-Britons will never shout unnecessarily, and we should reply each time, and leave the interpretation to them.

Some Night Notes.

In using paths or tracks at night, if a light cannot be procured, it is worth while remembering that the instinct of the feet is often a better guide than the straining of the eyes to see. The feet, left to themselves, will balance naturally along the track, much as the original makers of the natural paths found it expedient to balance over the same ground. They will be able to keep the track better of themselves than if they are driven forward by an ill-balanced body along an ill-seen line. A leader following a track by daylight may often wonder in advance at small wanderings which seem to the eye unaccountable; but as soon as the body in balance reaches the spot, it follows their sequence quite naturally. Left to themselves, the feet and body will do much the

same in the dark, and keep surprisingly well upon a track that is not arbitrarily interrupted.

In following a lamp, unless the leader holds it himself, his best place is not that immediately behind the lamp-bearer, which the selfish will press for. Detail and dim outline ahead are better seen from farther back in the line, where the actual glare of the lamp is hidden and the light is diffused over the way. The eye soon accustoms itself to half-light, but not to the dazzle of a flame.

(To procure light for a lamp, fire or pipe, especially in a wind, a familiar method may not be universally known. Part of the stem of a wax match should be unravelled and a few strands wound loosely round the head, so as to catch the first flare. To light a wood fire, in camp or hut, without paper, the wood should be shaved thinly upwards towards one end of a stick. The shavings should not be completely detached, but left curling up at the end like the flower on a stalk. Lit at this end, the stick easily burns and the fire follows.)

A compass and watch with radium points are always useful for all night hours or hut intervals.

If a path or track is lost in the dark, especially on snow-covered ground, the party should rope up at the full length of the rope, and make casts round the end man, who waits at a fixed point till it is, or may be, recovered. The motionless man at the fixed point acts as pointer for the original direction, and will prevent the complete loss of orientation in the circle of search.

In the dark on a track the increased risk from the axe-points before and behind us, as well as from our own, must be kept in mind, and extra intervals maintained.

Where there is no track, the last man on the rope should carry the radium compass and correct the direction, as in mist. Even without a compass he is the better able to keep a line, guided by the rope ahead.

A leader measuring the remainder of a climb against the coming of darkness must recollect that snow retains light very late—in summer, in fact, it rarely becomes quite dark. But the snowless lower slopes, which he will reach last, will be far darker. He must not be deceived, therefore, by the apparent amount of light still illuminating the higher snows, into taking things easily.

A party frankly benighted, if it has only a short distance to descend over ground known to be safe,

supposing that a right route, not difficult to find, can be followed, does best to rope up. This has the merit of keeping the party together and in line, and confines the disturbances of falling over rocks and into holes to the person of the responsible leader.

If he gets benighted on higher ground, as in the Alps, or sees that he must necessarily become so, the leader should look about for a good bivouac before the light fails; not press on to the last and then take the chance of hurriedly finding a suitable shelter or ledge.

Whenever there is no short or easy descent in near prospect, and night is at hand, it is always wiser to sit out for the few hours of darkness than to let impatience risk the chance of a sprained ankle or broken leg.

In selecting a rock for a bivouac in doubtful weather, he has to remember that unless the roof is absolutely concave, rain will trickle in and across the roof and make trouble even far within the shelter; also, that in sleeping on rock or sand or turf it is more important to comfort to secure a hole for the hip-bone than a pillow for the head of his charges.

Where only a ledge is available, the members of a party should rope together, to prevent anyone wandering away or slipping off in sleep. Song promotes warmth, and preserves harmony—in a sense.

Of the management of the guides during the tour something is said in a later section. If he has employed them, the leader's last task of management, one of regretful but presumably proud memory, will be to write up the guides' books. His fashion of entry is governed by no tradition; which makes these books the more entertaining and varied reading during dim days in the huts. But if he does not wish to blush in later years over his early paragons and phrases, and desires to make the notice, as it should be, of some service to other leaders, he may be guided by one or two common-sense principles.

A Last Task.

A mountaineer of experience, when he looks at a guide's book before engaging him, looks first for the signatures he knows, then at the opinions about the guide which they underwrite, and makes his allowance for the opinions according to his knowledge of the mountaineering equation of the owners of the names. Secondly, he looks at what the man has done, both with the names

he knows and with the names he does not know. The opinions of those whom he does not know he reads merely in relation to the actual climbs which the man is stated to have done with them. Thus, when we are writing, since our name is likely to be known but to few, especially among climbers of other races, it is of importance first to state clearly what the man has done with us, and under what conditions, of weather, party, etc.; more particularly, to state if he has 'led,' and what, or if he has come as second guide or porter. Then, for the benefit of our own race, who will know how to interpret the 'atmosphere' of an English testimonial even though they do not know our name, we may add an opinion of the man, written very carefully so as to be read in relation to that which we have stated he has done with us. For instance, if we have included several big snow climbs among our list, and then write our opinion that the man is a 'brilliant rock climber,' those who can read testimonials will know what to conclude about his icemanship. If we wish to guard against such a conclusion being drawn, and yet have had no opportunity of forming a clear opinion, we should add something conventional, such as that the man 'had no opportunity to lead on snow,' or that 'the climbs must speak for themselves:—the conditions were perfect.' At the end of a list of fine ascents to say only that a man is 'willing,' leaves us in the dark as to how far he took any real part. To say that he is 'enterprising' gives a clearer idea of his initiative. If the conditions of any climbs on the list are stated to have been trying, and the opinion adds that he is 'safe and good-tempered,' we have learned something positive to go upon. These are small instances. The comments should only be made with definite regard to what we have seen and what we state to have been executed in our employment. Unrelated generalities are valueless. Similarly, we must confine our appreciations to what our experience enables us to say with authority. It is better for this reason to refer our estimate to an absolute standard of merit, such as other mountaineers will understand, than to indulge our friendship by writing a character that means nothing to the initiated, and may get the man a place of responsibility with the uninitiated for which he is not fit. Our first duty is to other mountaineers. To say a man is a

'first-class rock climber,' if we feel ourselves competent to pronounce so much, is a definite classification; but to say he is a 'first-rate rock climber' is to err into the meaningless weakness of superlatives. To say he is a 'fine iceman' gives the guide the benefit of an authoritative reference to an accepted standard; but to say 'there is no finer iceman in the Alps' risks the calling of our own experience in question by those to whom our qualifications for making such a statement are unknown, and does the guide little good.

We are all inclined to think that our first good guide, or the man who has brought us well through a difficult situation, must be the finest fellow in the Alps; and in the moments of generous after-enthusiasm we are in a hurry to say so with an emphasis that we hope will convince a cold-blooded later reader that he is at least a very fine fellow. We produce the same effect better by stating exactly what he did, and our opinion of this rather than of him; leaving it to other leaders to draw their own conclusions about the man himself. We avoid then for the guide the peril of that natural revulsion towards an attitude of antagonistic criticism into which all northern humanity is prone to lapse in the presence of other people's enthusiasm, and for ourselves the tolerant smile of the time and guide worn mountaineer.

When we read in a guide's book, returning like an echo from the records we wrote in our own earlier and romantic days, that 'there is no greater rock climber in the present generation, a born iceman, an intuitive route-finder, a delightful companion and an unrivalled cook,' we turn on hastily to another reference, with yet a half-sigh of good cheer and thankfulness for the assurance that one more very young climber has started whole-heartedly on our pleasant mountain ways.

WEATHER

There is one variable which belongs to the mountaineering rather than to the human division of the problems with which management has to deal. The weather is the background, foreground and middle distance of all big mountaineering. A change can upset the nicest adjustment of a climb to the strength of a party or to the length of a day. Every climber keeps one eye on this irresponsible neutral, which may at any time turn the scale of the campaign against him.

As a result, no mountaineer will endure, and no leader can afford, not to be thought a good weather prophet, even though the reputation be confined to his own mind. In reality, so unaccountable are changes in the hills, any fame acquired for infallibility must be the result of a large share of good fortune. The happy confidence in his own forecasts, that every leader owes it to his party to display, can only be based upon a few broad considerations, and upon bluff. No previous appearance of a mountain sky can be taken as sure ground for certain prophecy. A particular wind or 'sign' may mean totally different weather in two adjacent valleys; or the whole doctrine of the winds may be unaccountably reversed in an exceptional season. In the Alps, for instance, a north wind usually means clear, brisk, settled weather; a west wind, the continuance of unsettled weather; a south wind, a succession of storms that come and pass. But the seasons from 1909 to 1912 will provide instances of the north wind blowing continuously through alternate days of excessive and moderating rain and snow, and of the south and west winds attending an unbroken season of hot sunshine.

A leader, therefore, besides his groundwork of elementary knowledge, has to make himself acquainted with local signs of wind and weather in every season and in any new district; with such details, for instance, as that in the Zermatt valley "the weather comes from the west," or that in Courmayeur we watch the south and west and do not bother with anything north of the

range. Further, that in the Oberland a north-west wind brings storm, but a north-east wind brings clearing weather; that bad weather follows closely on a wind blowing over Col Theodule and round the west of the Matterhorn, but that a wind over Col du Lion and round the Matterhorn to the east is a fair-weather sign. He has to discover the relation which the prevailing wind bears to the weather conditions of a particular season or month. The one thing he can count upon is the habit that weather establishes in the Alps during two summers out of three of remaining one thing or the other for a continued period, once it has started, and of returning to this 'habit of the season' whenever there are not evident signs that it means to recommence or continue a spell of change.

The scientific study of weather, and its prediction by the barometer and thermometer, are matters for a whole book, and the authoritative textbooks are available. Instruments larger than of pocket size are something of an encumbrance to a climbing party, although I have always made an exception in favour of the pocket aneroid, because of the excellent humour with which it blesses its possessor whenever its statements and those of the atmosphere or the map happen to coincide. I limit myself here to recalling briefly some of the visible, ordinary and less esoteric 'signs' which have proved of common use in my own experience, more especially in the Alps.

Clouds.

Clouds form our principal sign. It is important to remember that clouds, while they continue to retain their original form, whatever that may be, will inflict no rain on us. It is their changes, when they alter, that we watch, and we predict rain or not according to their character during and after the changes.

We distinguish between the upper strata of clouds, whose character and direction are important as giving us the eventual direction of the wind and the more permanent character of the weather, and the lower strata, which have only a meaning for the day or hour, and are not prophetic.

In general, clouds in the east alone are a fair sign; clouds in the west, especially dark clouds, mean rain soon.

High-travelling cirrus clouds portend rain. In the Alps, where the winds are our real prophets, a distinction is introduced: cirrus, high and fast on a south or south-west wind, has its usual meaning; but cirrus on a north, east or south-east wind may accompany or, more rarely, precede good weather. Castellated cirrus is always a bad sign, and, where the horizon can be seen, the appearance of cirrus in bands lengthening up towards the zenith (cirro-stratus) is an unwelcome event. Dappled cirrus, the so-called 'roses' of the south and the 'sheep flocks' of the north, implies a change of wind and weather. As the presence of high cirrus, upon which the change of wind can produce the dappling, usually means, in the mountains, that uncertain or bad weather has been preceding the change, the dappling is most often, and with justice, taken as a good sign. If, however, the weather has been dull, with merely clouds of heat, and the wind has been good before, the change portended will be probably for the worse.

Cumulus clouds, when they tower rapidly, and more especially when they 'topple over,' or show a tendency to do so, are signals of a change to rain. A sure method of observing cumulus is to watch some small portion of the cloud for a space of time. If it grows larger, the sign is a change for worse weather; if it ravels out and disappears on the warm air round it, the sign is for good, and the cloud can be disregarded.

Stratus, the long stratified bands of cloud at any height, means bad weather, and the tendency of cirrus or cumulus to stratify is ominous.

The edges of clouds tell us much of their import: harmless if they are filmy and ravel out on the warmer air; suspicious if they are hard, heavily outlined or charged.

An approaching rain-cloud in action is recognizable by the vertical or slanting lines in the air below it, or by the 'torn lace' on the lower edge. A hail-cloud shows heavier lines. A snow-cloud carries fuller, harder marginal protuberances, and may be lighter in tone. Heavy cumulus of this cumbrous sort may often surprise strong sunlight by a sudden snow-break. Usually we go by temperature and height in predicting if a 'wet' cloud will break in rain or snow.

High 'mare's-tails' betray wind, and predict rain according to their direction.

'Fish' clouds pointing east and west usually mean foul weather; pointing north and south, fair weather.

Black wisps of cloud before sunrise, especially in a clear sky, mean early rain. Lighter-toned wisps at this hour have no signification. But if the lower edges of cloud-films are charged and dark, looking like ink which has run down into the borders of blotting-paper, we look out for rain.

Long fingers of cloud radiating from a peak portend storm, particularly if any one of them betrays the typical thunder-curve. Thunder on a peak means snow, so we must look out for a cold and electric day.

Thunder-clouds are easily distinguishable. Their form is always similar. The duplicated outline in the masses of cloud above and below, the connecting darker neck between, and the leaf-like and invariable curve of strength where the neck runs out into the profile line of the upper mass, are sufficiently distinctive. A little further observation will enable their lines of system and the probable direction of their movement to be located. The lower mass of cloud may, in cases, be absent, but the truncated 'neck' and the leaf-like 'curve' will always enable us to identify them.

Even more than the clouds, once we have discovered the habit of the year and the local signs, the winds are our firm basis for forecast. The north wind in the Alps is usually for good, though in a bad season of habit it may, if long continued, bring snow. The south wind is always fraught with suspicion, until it justifies it. It brings a succession of storms, but leaves fine intervals. The west wind, if continuous, means the continuance of unsettled weather, with an inclination to preserve whatever may be the habit of the year. It is perhaps the most forcible and trying of winds to encounter on the ridges exposed to it. The east wind is infrequent and rarely long continued. Its portent is favourable. The south-west wind means rain to follow. A change from north to north-west threatens rain. A change from south-west to north-west—generally a wind on its way to becoming a north wind—means a change for the better in bad seasons. South-east, and especially north-east, winds share the good qualities and projects of the east wind.

Wind.

The current of the Föhn is recognizable by its

accompanying oppression of warm-parched, or in cases of warm-moist, atmosphere, and by its depressing effect upon our spirits. It is a harbinger of evil of all kinds. Its own forerunners are often a massing of heavy-bordered clouds accompanied by a threatening vividness in all visible coloration. The Föhn is said to be able to infect, or more probably alternate with, any wind from any quarter; but we know of it in summer usually in the south or south-west winds. In the south it is 'dry,' in the south-west it is 'wet,' Föhn. Its presence ruins the best-directioned wind; it underthaws the snow dangerously and spoils our tempers inexplicably.

Sudden gusts and round-the-compass winds are of ill omen. As between cross-currents of wind, at different levels, the higher alone is worth attention. Valley currents, particularly those off glaciers, are only misleading.

The simple sky signs, familiar not only in mountains, give us further assistance.

Signs in General.

A red sunrise is bad; a red sunset good. Sunrise on a grey sky means a fair day; sunset on a grey or pale yellow sky means a rainy day, on a bright yellow sky a windy day.

A 'high dawn,' the sun showing first over a vapour belt, is an ill sign; a 'low dawn,' the sun leaping from the horizon, a good sign.

If the distant sky at dawn, especially to the west, is low and dark, there will be breaking weather by noon.

A dark blue sky tells of wind, and probably rain to follow; a light blue sky is of fair weather.

All over bright or gaudy colours at sunrise or sunset, and all hard outlines, foretell rain and wind. Delicate colours, well-blended tones and filmy cloud edges are fine-weather prophets.

Rings round the sun or moon, and vivid twinkling stars in the later night, are bad signs. Clear nights of cold, and calm and quiet stars before dawn, are good.

Heavy dews and the falling of the wind at sunset are good signs.

The clearness and nearness of distant hills, except just after rain, is a bad sign; but here we may distinguish between a clear landscape when we face towards

the sun, which is an ill sign, and a clear landscape as we stand with our back to the sun, which is quite usually a fair sign.

Ascending mists on hillsides are bad. Mists in valleys at evening, clouds lifting at sunset, and hilltops smoking their pipe of evening peace, are good.

Warm airs as we pass up the lower alps or through the pinewoods mean us well; but warm nights on the height and in the hut, or the sickly puffs of warm breath that meet us from the large crevasses as we start up the glacier before dawn, are omens of ill weather.

Early rain, 'rain before seven,' has no serious meaning; it rarely lasts.

Early white mists should never frighten us from starting, but we must judge them by feel, texture and direction of movement. An early ominous mist has a different quality, and lies differently from a simple mist of the hour.

During the day feeling or instinct is still our principal guide as to the durable character of changes or of threats of changes. More especially we go by the feeling of the wind. With a good wind, local clouds may be disregarded. The eye learns to distinguish between the heavy leaden-edged look of an increasing mist, and the peculiar silvery wet aspect, markedly round its edges, of a mist that is in process of absorption in warm atmosphere.

One of the most beautiful, and baleful, warnings in the Alps is the view out and across a golden sea of clouds washing up out of Italy or from the south. They often signify the Föhn. So long as the wind blows off the mountains, they will be kept below for the day; but once they begin to make breaches in the walls and surge over the battlements, a bad afternoon or morrow is in prospect. The change from their golden, fairy-like distant greeting to their wet, cold and gloomy embrace makes us reluctant to recall that they are really the same clouds we admired those hours before.

On large peaks there may be severe local storms even while the sky in general remains undisturbed. Rock peaks, for example the Matterhorn, are conspicuous offenders. A small blister of dark, steady cloud may imply a raging storm on the face below it. Not only at the moment, but as it affects the later condition of

the mountain, the occurrence of these storms has to be reckoned with.

From a spell of covered or of broken weather we look for a clearing snowfall as our deliverance; and the more confidently if the wind has continued throughout to blow from a good quarter, north or east. If the fall is followed by clear days and three cold nights, we shall find our high ridges in perfect condition again. If the weather continues broken and therefore warmer, the snow will at least not have made things worse; it will have thawed rapidly. It is also worth remembering that in warmer, broken weather what has fallen as snow at one level may have been only rain at another, even at a higher, and the moment the clouds clear we shall be able to profit by the calculation. I have known the same storm to have fallen as rain in the valley, snow on the slopes, and rain again on the high ridges.

Habit of the Season.

The habit of the season is always the first matter of study on returning to the hills. In a habitually fine season, it is safe to go up to a hut even on a bad day, on the fair chance of a fine recovery on the morrow. For the same reason, in a habitually bad season, it is too late to wait for the fine day, and then go up to the hut or out to the camp. A leader who braves the ridicule of the hotel and the gloom of the glass, and takes his party up to the hut, with hope undiminished by failure, on bad days in uncertain seasons, will catch each short break as it comes, and get a record of climbs that will shock his valley advisers. He must base his choice, as between the bad days, upon his observation of the habit that is governing the vagaries of the season. A very common feature, in unfavourable alpine months, is the alternations of possible and impossible weather occurring almost every day—a wet day, followed by a fine morning; a breaking afternoon, and again a wet day. It is thus most important to "get the alternate right," and to correct the order of his going, if to ascend to the hut on each first fine day proves disappointing. In a recent so-called 'bad' season a party ascended thirteen peaks in three weeks, by getting their 'alternates' right at the start, while most parties got only four or five expeditions in the same time. Occasionally the alternate is one fine day, or fine half-day, in every three. To meet this

habit, or to discover the order of the alternates in the first place, it is sound to take up two full days' provisions to the hut, and to wait there for a day, if the first day fails to change. A fine morning will suffice for most climbs suitable for uncertain weather, and a party who have had courage, and faced the mist, and enjoyed the empty hut at night and a long fair morning's climb, will often be granted the extra pleasure of meeting the usual crowd swarming up to the hut in the afternoon, attended by every sign of the regular return of clouds and rain.

Persistence.

The real principle is to keep on trying in unchancy seasons, and back up the effort by whatever weather instinct or opportunity of observation we may enjoy. In valleys continuously cloud-covered observation becomes uncertain; often the weather may be already clear at higher levels while it lurks in mist in the valleys. Instinct as much as judgment must then tell us if we may chance a start, on the probability that the cloud is really thin and the summits in sun. An attempt is always worth while if the party is getting depressed by a succession of days of idle cloud in the hotel. Chance often helps our predictions. The occasions when instinct or a momentary sight of the higher and important clouds has given the impulse, added to the occasions when a bold face has been assumed, in spite of a low blanket of mist round the hut or hotel, and a start has been ordered on the chance at the best of clear weather above and at the worst of a bracing tramp up and back, all taken together have made many a lasting reputation for miraculous weather wisdom. Some of the most enduring mountain memories are of days thus retrieved from weeks of ill weather, and spent upon sunny peaks projecting, with only a few isolated and lofty companions, from the seas of cloud that covered all the valleys and lower heights, and with them most of our less fortunate fellows.

Until we possess local weather knowledge, and have rather more to go upon than bluff, a climb should never be actually started in threatening weather, still less persisted in against bad weather; which is a different thing from insisting upon going up to the hut or to the base of the peak on the chance of a change.

Snow, and continued rain, which may mean snow at

higher levels, must be accepted as definite bars to starting at all.

Cloud, however, is less justifiably used as an excuse for delay in leaving a warm hut on a dull morning. The personal bias in prediction must be allowed for before dawn. Guides, who are too often treated as infallible prophets, are as susceptible as amateurs, at this hour especially, to specious promptings from the spirit of comfortable inaction. They are apt to delay a start hour after hour, in a hut or camp, for the mist-bank to clear and the day to show its hand; and this with entire unreason. If the weather is going to clear at all, it will do so at the earlier hour at higher levels; and it is common sense not to lose valuable time. The sooner we go up the sooner shall we meet the sun, or find out that it is not there for the day.

Even a stay in a hut is more tolerable than confinement in an hotel. For this reason, and to save the time and patience spent upon going up and down from the hut, as well as to be on the spot to catch the right day, it is often pleasanter to stay up at the hut, and send down a porter each day for provisions. We are then ready when the change comes in uncertain seasons.

Snowfall, however, with its hopeless prospect and unpleasing chilly presence, will suffice to send us down without question. Continued snow will send us yet further; unless we can arm ourselves with the short summer ski. In that case we may still refuse to admit defeat, and mint golden days out of the ashes of a heartless season.

I am speaking here only of weather in the Alps. In more distant and less hospitable ranges, where the base camp and the rescue of civilization are more remote, the same persistent course cannot be maintained in face of continued bad or changeable weather. In small climbing, as in Britain, we need not regard weather at all. It enforces all the observation it deserves by the definite limits which wet or snowy rocks put upon the degree of difficulty which it is safe or comfortable for us to attempt, and by the temporary discomforts and restrictions that wind or snow inflict upon our daily expeditions.

TRAINING

The Framework.

If any layman in anatomy has ever kept his fingers on trunk or sides while walking down or up hill, he will have been astonished at the amount of work that is done by groups of muscles wholly remote from the calves or thighs upon whose development he has proudly relied. Suppleness and an even development of hardened muscle all over the body are what tell in climbing, not local bulges. Most men are designed by nature to develop most spring, suppleness and strength at a point of general muscular development which will never earn their portraits a place beside the corrugated limbs of the gentlemen on the hoardings. Of course a naturally big-muscled man must remain big-muscled. But it is the quality of the muscle that counts. Whatever there is, large or small, it has to be spun into fine silk. Any effort to develop unduly some group of muscles, in arm or leg, will even prejudice the ease with which a man can recover in training the harmonious control of his machinery at its best ; and the artificial muscle is apt to degenerate into fat when he goes out of training. A man, evenly developed according to his potential strength, even when he goes out of training has little difficulty in preserving a level, if lower, plane of general fitness and suppleness ; and when the time comes for winding up or for relaxing, his condition moves evenly and easily up or down, and he is ready, in a few days if he is young, in rather more as time goes on, to climb again at his best.

To keep in moderate training out of season, any regular exercise in the open air is sufficient which exercises different parts of the apparatus of the body in their relation to one another, and which holds the attention. Monotonous repetitions of particular muscular movements are of little service. They bore the mind and weary the nerves ; and it is the interworking of his nerves, muscles and will that a climber has to train. If he is prevented by circumstances from getting open air

exercise, he may find fencing the most effective, concentrated and lasting indoor practice which he can fit conveniently into his working day. An hour's hard fencing with both hands, comprising exercises, free play and a cold douche to finish, uses every muscle and connection of the body to the full, but risks no local strain. For in fencing every movement must be supple and yet controlled; the whole system is kept concentrated, and at full tension, upon movements minute, quick and fine. The training in rapid adjustments and lightning reactions is invaluable to the climber, and its unboisterous character makes it possible of continuance without prejudice well into old age.

If he can face them, dancing and skipping are admirable exercises to the same end. Tree climbing, or even haystack climbing, where possible, are also fine climbing practice. Swimming and sculling exercise organs and muscles smoothly and develop them evenly. Swimming has no equal as an exercise for growing strength. It runs no risk of violent local strain, and it cannot be continued beyond the point of wholesome fatigue. In all its varieties and attendant circumstances it combines more educative merits than any other form of open air sport.

My own view is that the development of special groups of muscles is best left for the climbing days themselves to effect. 'Morning exercises,' before the cold bath, are excellent to get the circulation right, and better than nothing for climbers whose day allows them no more wholesome outdoor activity. Among special exercises I should put first those that strengthen the forearm and fingers, for 'gripping'; those that build up the muscles of the trunk, which have the greatest share of work to do in climbing; those that train the body to balance easily up and down on one leg, for balance; and those (if there are any but wood chopping) which prepare the shoulders and trunk for the movement of step cutting. But the working in easy combination of groups of muscles is what the climber aims at. Excessive exercise of independent groups is apt to militate against quick muscular interaction. It is well, therefore, to make movements in combinations, and constantly to vary them. This helps to keep the attention concentrated. So does a looking-glass. Boredom invalidates

the whole effort. Each movement should represent a separate effort of the will.

The Organs.

For a climber the lungs and heart must be the chief care. The action of walking uphill, the lifting of foot and arm continuously and with effort, make a sustained extra demand upon these organs especially. In climbing they have to supply the fuel consumed in muscular effort, and to throw off the poisonous residue, in greater quantity than in normal action, and at an increased pace. The effects of the extra effort, shortness of breath, fatigue, exhaustion, even, in cases, suffocation, are symptoms of the failure of the heart and lungs, in varying degrees, to maintain the equilibrium between the supply and discharge of fuel. The muscle cells and the lungs are being starved of their substance, and the acids are accumulating too rapidly to be naturally got rid of. The heart is consequently enfeebled, the lungs get choked, and the exhaustion increases progressively. The severe muscular strain of a difficult rock feat is in this way doubly exhausting. The local tension is consuming the muscle cells at an abnormal rate, and therefore putting an excessive demand upon the heart and lungs to keep them supplied; and at the same time the contraction of all the great muscles of the trunk, involved in the local effort, is compressing the great organs from outside, and thus impeding their action in producing the increased supply required. Hence the 'panting' of an untrained climber after any severe rock passage, however short the effort.

Now, both heart and lungs can learn by practice to perform their normal functions at more than double their normal rate, and yet to maintain the equilibrium in the supply and discharge of fuel such as is needed to allow them to continue their free action.

Hence a climber is concerned to accustom his heart to accelerate, without enfeebling its action and thus diminishing the amount of fuel which each pulsation is supplying. Also, so to exercise his lungs that a number of breathing sacks, not usually employed, may be ready and accustomed for easy use whenever the extra call may be put upon them. By practice a number of dormant lung sacks, as well as those in normal use, may be actually increased in elasticity and volume,

so that the lungs as a whole will be prepared to receive a far greater quantity of 'breath,' whenever that may be required for a greater effort.

The training for the heart is a regular and increasing graduation of effort, developed in healthful exercises such as walking, running, swimming, wood chopping, etc., and practised until even a violent or long-sustained effort can be made without panting or discomfort.

The training for 'breath' is deep breathing; from the bottom of the lungs, and through the nose as much as through the mouth; practised either in the course of natural open air exercise, or, almost as effectively, by slow inhalation and exhalation, for a few moments each day, in the best air obtainable. To increase the capacity of the lungs is to increase the chest measurement, that healthful vanity which mountaineering, above all exercises, flatters. Contrary to our ideas as boys, this is effected from the inside, by breathing, and not from the outside, by arm exercises, etc. 'Chest' exercises, indeed, help to make supple the ligaments of the outside framework, and so permit of a greater elasticity in the breathing cells within. Otherwise they are only of use in so far as they demand, or are accompanied by, deep breathing.

Will and Nerves.

A climber has also to remember the very active share that his will power must take in difficult or prolonged mountaineering. He depends upon his will to supply to a large extent the impulse, physical and moral, when nerves and muscles begin to show signs of unwilling service. Among some of the greatest of mountaineers, will has to a notable extent supplied the place of physique. They have climbed on their 'vitality,' as we say; on the success of their will in maintaining the impulse to movement long after the muscles have protested their inability to continue the rate of consumption of energy.

The impulses of the will are communicated physically. Their transmission exhausts nerve-fibre as materially as muscular action. As the muscles tire, the messages from the will quicken and increase. The nerve transmitters get irritated, and finally revolt. As a result, we have the frequent mountaineering symptoms of ennui, irritation, conscious fatigue and, in extreme cases, of complete nervous incapacity to resolve upon making another step.

But the nerves call for a truce before the muscles are actually exhausted. The muscles, male fashion, invariably protect themselves by retaining some reserve of energy, if only a way can be found of exacting it. Some new interest or excitement may do this; the messages are then switched on to other nerve-lines, the congestion of monotony is relieved, and the will resumes control of the communications, to the extent of obtaining whole hours of further effort from the striking muscles.

But training offers us a surer way of postponing or avoiding these strikes. The body is animated in two fashions from the spinal nerves: by the messages that pass through the brain—I speak as a layman—and by those which serve that mysterious but autocratic regent of our habits, the 'subconsciousness.' Under the latter are grouped all our automatic actions, and the more actions we can qualify for admission to its extremely select group of well-ordered subjects, the fewer sequences of orders will the dictator-brain have to promulgate on their account, and the less congested will be the nerve-lines of communications. Walking, for instance, is, with most people, a subconscious action. Once the impulse to step out has been given, the legs will continue to walk automatically so long as the look or feel of the familiar smooth surface continues to suggest the familiar reflex. A change of surface may disturb and therefore make the effort conscious; otherwise the walking can be maintained without fatigue for a much longer time than the same group of muscles could have held out had they been performing some unfamiliar action, and therefore been under the direction of conscious impulses.

The human frame, in attaching itself at two, three or four points to any ordinary surface, is capable of only a limited number of positions. Holds upon rock or ice, suitable for use, not unnaturally recur frequently in similar groupings upon the same type of surface. Consequently, there are whole series of positions of the body and limbs which are constantly repeating themselves in climbing. The more of these subconscious associations which a climber can succeed, by practice, in establishing, as between familiar sequences of holds and automatic adjustments of his motions to their requirements, the fewer calls will he have to make upon nerves and will, and the

greater, therefore, will be his endurance. It is largely on this account that a climber, as he gets experience, finds that he can climb with always decreasing effort. It is for this reason also that long, continuous rock ridges, with oft-recurring situations, form the best initial training for young mountaineers and the best annual reintroduction for their elders.

A climber who can get away, if only for a day or so, at frequent intervals, to rocks small or big behind his house or on convenient hills, secures the best training for his balance, his nerves and his muscles, not by attempting extravagant gymnastic problems, but by practising, and always adding to, the number of his sequences of familiar climbing movements. He must learn to perform these with such facility that, finally, their execution becomes subconscious. On a long climb ten out of every twelve situations will be familiar to experience. Suitable training will enable him to meet these ten with the right motions, without conscious effort, automatically. The nerves and the will-power are thus economically kept in reserve for the remaining two.

Nerve.

Many of us take a day or two at the beginning of the season to get back our 'nerve.' We boggle at a bold reach, or feel inclined to crawl where we know we should stride. This is not due to any fine new sensitiveness to mountain danger, acquired during our civilized sojourn in the plains ; it has nothing to do with vertigo or effect of height. It is simply lack of condition. By inaction we have allowed sets of automatic motions to become unfamiliar. The will has, therefore, to take charge, and does so tentatively, like a professor of metaphysics left in charge of a class of elementary school-children. The nerve communications are sluggish from disuse ; the muscles are out of control, and distrustful of what the arbitrary will may ask of them. We become 'nervous,' and potter. This can all be avoided by reasonable and light practice. Regular exercise of the heart, the lungs, the muscles and the nerve-lines of communications, with occasional repetitions of our groups of familiar subconscious motions, will maintain a general level of fitness even out of training. If the machinery is kept working smoothly, we can soon get it going at high pressure again, and can return to top condition without any local strikes or

nerve signals. The final tuning up to meet the call of the mountain holiday will then proceed easily, of itself, in action. For a man whose system is set, and who practises a consistent habit of living, the amount of actual exercise required during the intervals to preserve his elasticity is usually small, and tends to diminish. This is one of the compensations of advancing years.

Height and Reach.

No man by any pleasing afterthought can add to his height; although by suppling his shoulders and lengthening by exercise his trunk muscles he can extend his apparent upward reach. The stride of the tall man before us over soft snow; the long-armed man's careless caress of a salvation hold well beyond our reach; the inimitable and perpetual rhythm maintained by the Agile Gibbon of the Zoological Gardens, on the security of his four whiplash limbs,—these are natural advantages, whose injustice we may challenge but not compete with. Their regretful contemplation suggests, however, the possible usefulness of a warning, and some consolations.

A man of great reach, whose span from toe to upstretched finger approaches or exceeds eight feet, has one undoubted advantage on difficult rocks, where holds are rare and precious. If his legs are long enough to allow him to sit across the smooth sheer walls of a chimney or to straddle it on small footholds, he has yet another. But he must expect to suffer from the drawbacks incidental to height. A tall man may be weak in the body muscles, with less suppleness and ease of balance, or, if he is muscularly developed all over, his weight is apt to increase with time out of all proportion to the suspensory power of his fingers on small holds. If he is tall, slight and sinewy, his strength of arm and hand is rarely proportionate to his greater weight, or equal to the greater expenditure on leverage which height requires of arms in balance climbing. If he is tall, muscular and heavy, this weakness pursues him in the same ratio. If chimneys are narrow, he is too long to 'bridge' them securely; if the holds are tricky and slight, he finds greater difficulty and effort in 'folding up' so as to use them, and in keeping his centre of balance well in and above his feet. It is a consolation for a short or slight man that great experts in climbing are to be found among men of every build, with a preponderance in

favour of those of medium height and of sinewy and supple rather than of big muscular development. The outside feats of rock climbing, the abnormal climbs made by a few men in recent years, undoubtedly require abnormal strength of finger and arm, not seldom accompanied by great size of hand. But these men have also possessed an equal development of strength and rhythm in body and leg; their all-round design has been abnormal. When, as in one or two cases, their exceptional physical development has been assisted by great height or great reach, without loss to rhythm or balance or to the sterling quality of supple sinews, the perfection of the climbing machine has been attained.

For the normal climber to imitate the performance of these men is to incur a proportion of danger, the measure of the interval between their abnormal reach and power and his own, expressed in terms of all too distant or too indefinite rock holds, such as no sane man has the right to risk from any emulative or competitive feeling.

Every climber has to recognize that there is an absolute upper limit to that which it is physically possible for a body of his design, when developed to its utmost, to perform. If he concentrates upon an even and efficient training of his own measure of power, and climbs always well within his confident capacity, he will have the gratification, as time goes on, of finding that his improving knowledge of himself, added to his increasing experience, enables him, little by little, to reduce the margin between his own achievements and the humanly impossible.

By a pleasing accident in rock structure, rock is either utterly impossible, smooth or stratified at gigantic intervals, or its cleavages and intrusions, and consequently its holds, occur at intervals within the average man's reach. While a tall man has, therefore, a greater choice of holds, qualified in his case by a greater effort in using them, a shorter man has only to perfect his skill, and to profit by his lightness and balance, to be able to keep level with him in performance on all normal rock. Again I except the superman climbs, which are climbs made by exceptional men upon exceptional accidents in rock structure.

As a further compensation, peculiar to advancing years, a lightly built man who lives healthily finds less

difficulty in recovering a condition of hard training and in keeping up his standard of achievement. Failure in wind or increase in weight may make the process of recovery longer each year by a few days, but he has not the handicap to contend with which threatens the big or heavily muscled man, who requires constant and intensive exercise to check the local degenerations which increase with time.

Climbing is one of the few exercises that can be continued well into what used to be deemed old age. Trained nerve, tough sinew, supple muscle, experience in adjustments, in balance, in foresight and in economy of strength, compensate for the loss of youth, for its fire and spring. An old climber of the balance school can mountaineer in the front rank until the last, and, by a happy compensation which no other interest enjoys, when the deterioriation of the body finally begins and the natural powers fail, the desire for the fiercer emotions of difficult climbing contentedly diminishes. In their place the inexhaustible mountains discover a whole range of subtler sensations; returning for our feet the echo of lost rhythmic movements perfected by complacent memory, and using even the shadows of our sunset years to throw into relief treasures both of human and picturesque interest, which were unnoticed or hurried over in the daylit enthusiasm of athletic youth.

PACE

Pace is a matter of vital importance in mountaineering of any magnitude. Unfortunately, guide-books of recent years, by recording the 'best times' taken on ascents for future guidance, have given a certain amount of encouragement to racing for records and so to competitive climbing. A confusion has thus been produced between pace and racing in the minds of many sound mountaineers. The mere mention of the word 'pace' provokes them to a protest against record-breaking. A natural, but equally dangerous, reaction has followed, which condemns consideration of 'times' altogether, and advocates "idling on the great ridges" as the peculiar joy of the guideless or the true-hearted mountaineer.

Pace does not mean racing. It means the adjustment of the length of the climb to the length of the day,

Adjustment of Time.

and the adjustment of the progress of the climber to the length of the climb. A certain amount of ground must be covered in all great ascents, and there are only certain hours of daylight in which to cover it. No mountaineer is competent who cannot relate in advance the measure of daylight at his disposal to the measure of the distance to be traversed, and keep to that measure in action. Only the men who know how to save time upon this calculation have it to spend upon hours of luxurious rest and interval. There is nothing more fatal to pleasure or to safety than to realize, perhaps too late, that the race with darkness and benightment has begun. Those who are loudest in the valley in their protest against climbing by the watch are the most often challenged or beaten by night in this, the most dangerous form of racing.

Getting benighted is not a pleasure, and it is rarely necessary. It has been given a false halo of romance by the practice and the picturesque descriptions of a number of guideless mountaineers, who first render it

inevitable by attempting what is beyond them, or by carrying great weights, and then seek to convince themselves and the world that the consequent night out on a lofty ledge or glacier forms an essential and agreeable part of mountaineering. It is neither. On a rare occasion it may be unavoidable, as the result of unforeseen circumstances, bad weather or altered conditions coming on too late to allow of the proper alternative, which is to turn back in time. If benightment is frequently incurred, it is a sign of some grave defect in mountaineering judgment. As a habit it is folly.

Benightment.

By daylight the climber has the hundred chances of activity, warmth and sight in his favour. At night he is the passive and blinded recipient of any evil chance that storm, cold, wind, illness or accident may bring him. To be on a mountain unprepared at night is to increase the percentage of danger incalculably; and stars, sunrise and sunset can be enjoyed without its unaccountable risk.

Most European mountains are of a height to be climbed, with a reasonable calculation of pace, in a single day. When they are beyond this range, huts are to be found, or a bivouac can be contrived. The night out by intention at the beginning of an ascent has more than the romantic pleasure, because none of the dangerous discomfort, of the night out by miscalculation at its end. This reasonable anticipation presupposes a precise estimate in advance of the pace required, as well as of the length of the climb. Such an estimate does not mean fixing such and such hours for so much of the ridge, and so much time for every halt, which is slavery; but it implies a general preconsideration of what ground must be covered and within what general divisions of time certain fixed points should be reached in order to allow of a safe return by daylight.

Pace is the regulation of the progress, and of the halts, of the party in relation to these general fixed points.

To carry unnecessarily heavy loads as a precaution against cold or hunger in case of benightment—a very common custom—is to increase the actual probability of the event by further checking the rate of progress. It is better to go as light as possible, with the minimum of portable pro-

Weight Handicaps.

tection sufficient to preserve life in case of ill-fortune, and to concentrate all the energy upon a timely conquest of difficulty, such as will ensure a return before night. The muscles, not unduly weighted, must see to it that there is always a margin of time in hand upon the estimate, to allow for unforeseen checks.

With regard to this there is another common error. Those who confuse pace with racing, picture a party rushing breathlessly over easy and difficult alike, and panting at their rest-points watch in hand. As a reaction from the picture, they themselves make the long, easy passages that constitute the major part of most ascents the occasion for a relenting rather than a quickening of pace; with the result that they have no margin of time for the unforeseen or the unexpectedly difficult passages.

A party that does good times takes each passage at the maximum pace consistent with comfort, allowing for its degree of difficulty. It has consequently always time in hand to allow of leisurely exploration, when found expedient, and of a more careful overcoming of the real problems when they occur.

Continuous Going.

Pace means the continuous progress of a party over the whole length of a climb, allowing reasonable variations for more complicated passages or for halts. It will be found that a party that does good times rarely hurries. It is, after all, human, and it dislikes being pressed. Nor has it any need to be. An experienced party starts slowly—more slowly, usually, than less expert climbers. It knows that pace to be good must be effortless, and must become mechanical, and that the muscles must be given time to get warm and work up to their automatic rhythm. Once this rhythm is attained it will, for the sake of good progress, avoid alike both hurrying and frequent halting. To hurry will interfere with the bodily functions, and react upon heart and lungs and will; and to halt will disturb the rhythm and chill the muscles. It will aim at continuous steady going, and save its seconds and minutes over ground of easy movement, ready to spend time freely again so as to economize effort on more difficult passages.

Combination is the secret of saving seconds. Con-

sider for a moment the case of a roped party that has not learned the secret of pace, and is moving all together on easy rock. Inattentive to a common rate, one man lags, one goes unevenly; there is constant check or turning round to talk, each with its break of continuity of rhythm. On a three hours' traverse of broken ridge half an hour will have been lost only in disentangling the rope on such interrupted, uneven going. The leader, at the end, will be vexed at the shorter time given in the guide-book, and expostulate, with justice, "Why, I was hurrying all the time!"

Combination.

Or again, watch a party of average amateurs moving one at a time on steep rock. The first man reaches his ledge, preens his plumes for a second or two in the sun of his success, possibly discusses it in detail with his second man below, looks round for a hold or belay, takes a position, alters it, and shouts, "Come along." The second calls, "Are you all right?" The first man is disturbed, readjusts his body, gets back to the old position, and says "Yes," or "Half a moment." Thirty seconds or more will be gone before the second man can start. He reaches the ledge, does not take note of the first man's position for holding before it is surrendered to him, and has to rediscover it anew, all with the same delay; and another half-minute is gone. If this performance is repeated, as it will be, several hundred times in the day, by one or more of a party, two invaluable hours at least will have dropped completely out of the allowance of time for the climb! The party will remember that they did their actual climbing fast; on their return they will look up the better 'times' of the book, and abuse their predecessors for 'racing,' for 'dangerous pace,' etc., whereas the only difference has been that their predecessors saved, while they wasted, innumerable, all-important, intervening seconds.

Continuous progress is the essence of pace. While a party is in motion, the effort should be directed at keeping the pace constant, not at hurrying it. There will then be larger margins for completer rests at the proper halting times and places. Time can also be saved during halts. It is a great mistake to hurry men over their food; a due allowance of time should be made both for food and rest. But

Halts.

the time of rest should be used for resting. Too much of it is usually lost, and more than intended is often taken, in standing about at the beginning of a halt, or by slackness at the end: one man has misplaced his axe; another finds out for the first time that his puttie wants rewinding; and so on. Once the time allowed for the halt is over, the packing and restart should be brisk and immediate. Rest intervals are assuredly a part of the day's measure, but dawdling at their edges is time lost from the climbing hours, not time added to the resting.

The Maximum Rhythm.

Moving slowly is not less effort than moving reasonably fast. The muscles in movement generate their own warmth, which is the body's energy. Muscles when in training can consume and create their own energy at more than their normal rate without more effort. The maximum pace for a man is the highest rate of effort at which his system will carry on its functions without demanding direct impulses of will from the brain, and without generating more waste matter than it can naturally consume and discharge. Each man has his maximum rhythm, which varies according to his condition. Up to this maximum he can climb, when in training, without feeling increased fatigue. Above it, his system will soon feel symptoms of exhaustion; below it, he gets no profit from the relaxation, and even suffers some prejudice to his energy in the loss of a sustained rhythm.

The pace of a party is the maximum rhythm of its weakest member.

A good mountaineering party moving continuously and in combination in the common time of its comfortable maximum rhythm will gain steadily on a less experienced rope, although it may allow itself longer definite intervals of "idling on the great peaks," and spend even more moments on its difficult passages. The margin in time which it will save will serve, on a well-calculated day, to see the party of sustained pace down to easy going before darkness. The one party will be home to dinner; the other may be still struggling at midnight with the quadrupling of difficulties night brings in its train, or sitting out and relieving its feelings by accusing the former party of 'racing.'

Gradual beginning, gradual acceleration and un-

interrupted moving on a steady top-gear of comfortable pace keep a party fresh, and leave it free to appreciate the beauty of the day or of the climb. Its mind is relieved of care as to a timely return, and it can enjoy a margin of leisure, when it pleases, in pleasant exploration, in essaying experimental routes or in the meditation that mimics slumber.

The real freedom to rest, to idle and to enjoy themselves where and when they will, is only for those who have the measure of their day well in hand, and who know that their collective pace, their maximum rhythm of comfort, before it can rise to a rate of disagreeable effort, has a point or two of pressure still to spare, to recover lost ground or to meet emergency.

CHAPTER II

EQUIPMENT FOR THE ALPS

BY J. P. FARRAR

Equipment

TOO much attention cannot be paid to the question of equipment. The careful mountaineer must always be prepared to face bad weather and the possibility of an involuntary bivouac when the exposure may be very severe. At the same time, his outfit must be as light and simple as possible. My recommendations are based on the experience of a great many years' active service in mountaineering, during which I have had to face most of the contingencies which the pursuit involves.

Boots.

Boots should be made of very stout cowhide, *unlined*, worked to the softness of thick buckskin. The back and sides should be in one piece ('navvy back') and of rather thinner hide, and as soft as buckskin gloves. The front part must, above all things, not be tight over the big toe-joint, which needs plenty of play, or over the toes, i.e. there must be plenty of *height* (i.e. like a modified ski-boot) as well as width for the toes. The test is, that one must be able to move one's toes readily—in fact, crumple them up inside the boot.

The boots must fit tightly over the instep, so as to prevent the foot jamming forward when descending. The eyelet holes should be close together, not more than half an inch centre to centre, the first and last ones being put close to the ends of the lacing. The tongue of thin, soft leather must be sewn to the sides.

For many years I have had the uppers of my boots made very short—just over the ankles like a rather high shoe (four inches from the top of the heel to the upper edge). They leave the foot very free, lighten the boot, and, when properly fitting and of soft leather, lace up

tightly and prevent any snow or stones getting into the boot, thus dispensing entirely with putties or gaiters except on big, cold snow-mountains.

The soles should be not over §-inch thick, and the same thickness in the waist. They should not project, but must give width enough for a full tread. The heels should be not more than one inch thick, made long and *rather projecting*, so as to give a firm, wide tread. They must be sewn—not pegged—to the sole. Fatal accidents have occurred through the heel tearing away from the sole. Attention must be paid to the inner sole or floor of the boot, the edges of which must be bevelled off or they will damage the sole of the foot. A loose sole of cork or felt should be worn inside the boot.

I dispense with toecaps, or have a very short one just covering the ends of the toes, as I have never found a bootmaker who could put on a toecap of the regular length without contracting the end of the boot and compressing the toes in a dangerous manner.

The ordinary bootmaker knows nothing about an alpine boot, which is very different from a shooting boot. The fault of Swiss-made mountain boots is that the leather is very hard and the boots much too cumbersome and heavy. A guide's equipment is the very last to be imitated.

The measurements for boots should be taken standing evenly on both feet and over the mountain sock and stocking intended to be worn. The boots must not press uncomfortably at any point even when quite new. They need not permit of the inner sole being worn for the first time or two of using, but must after then permit of *lacing up quite tightly*. No hesitation must be permitted in rejecting boots that do not fit perfectly well, as damaged feet may lay a man up and cause his party delay and loss.

Of course, a mountain boot should be broken in beforehand.

A good pair of London-made boots will cost, pre-war, from £2, 10s. to £3, and are worth the money. The fit and make of boots is of the utmost importance. Boots tight in the toes cost one of my companions the loss from frost-bite of the toes of both feet.

Never let your boots out of your possession. Boots

burnt in the drying caused severe frost-bite to a very well-known alpine climber and Himalayan explorer.

An *unlined* boot such as described will dry very quickly if stuffed with dry paper, hay, straw or oats—changed at intervals—and only requires a little castor-oil rubbed in before each expedition to render it quite supple and able to turn a lot of water. Boots should never be dried by a fire nor put in a hot sun for more than a very few minutes. The *unlined* boot is also more porous, so that the foot has less tendency to get hot and damp and subsequently cold.

In a hut, boots should always be stuffed as described, and this is even more important in a planned as well as an impromptu bivouac, as otherwise they freeze hard in a bent or twisted shape, and are very awkward to get on. A pair of light cloth slippers may be carried, or a pair of very light shoes for walking on occasion.

Nailing Boots.

Do not use too many nails. The so-called wing-nails overlapping each other all round the soles are absurd, and wear perfectly smooth. About six wing-nails kept in position by flanking hobnails as described may be used for the toes.

Wrought-iron cube-headed nails with long shafts, obtainable in the alpine centres, set all round the edge of the soles ¾-inch centre to centre, including the waists, and clenched through, do all right. About seven or eight nails placed at suitable intervals are enough for the tread part of the soles.

The front edge of the heel should have about six nails set close together, as it takes a lot of strain down-hill; the others can be placed as on the sole-edges. One nail is enough for the centre of the heel.

Several patent nails have been introduced, among which the so-called **U.H.U.** Stollen, which are screwed on, are very efficient, but require some attention to see that the screws do not work loose. I have used them for years with satisfaction. They are obtainable from Max Seib, Karlsruhe.

An even better nail appears to be the lately invented Tricouni nail obtainable from W. Stern, 40 Brazennose Street, Manchester, illustrated opposite. The notched pattern (Model D), price now 11s. per 100, are best. They must be set *as close to the edge* of the sole as possible, with intervals of ¾-inch to 1 inch, and continued right up

to the heel. They must, of course, not be driven in the sewing of the boot. Along and close up to the front edge of the heel should be set four of the nails *broadside* on, the two outer ones reinforced close behind by two nails *endwise* and with three others round the heel at equal intervals. Tricouni nails can be used for the tread of the soles, or almost preferably half a dozen wrought-iron hobnails suitably spaced. Tricouni nails

are specially hardened, and are said to retain their sharpness till quite worn out. The plates, no doubt, protect the sole somewhat. They certainly give a firmer stand than any ordinary nail, besides saving considerable weight.[1] A few small hobnails may be set in the waist of the boot.

Stockings.

A short sock of Norwegian natural wool—thick and coarse—and *perfectly easy*, especially over the toes, should be worn. They are obtainable at the alpine centres, and also at Lockwoods, 42 Jermyn Street, S.W., being used for ski-boots. Over this should be worn a long woollen stocking of stout, rough wool. The feet must be big enough to fit *comfortably* over the inner sock *without contracting the toes in the least.* They should be long enough to come 4 to 6 inches above the knee in case of an impromptu bivouac or very cold weather. Continental climbers wear 'Wadenstutzen,' i.e. stockings without feet. With these only spare socks need be carried.

Buy socks and stockings big enough, as they shrink.

The double sock and stocking and inner sole are meant not only for warmth, but also to save the foot from damage ensuing from long days on rocks and rough paths.

Remember your whole journey may be spoilt, and your own and your companions' time and money wasted by damaged feet.

[1] Cf. an article by O. Eckenstein in the *Climbers' Club Journal*, 1914.

Gaiters. Gaiters are not really needed except for long snow expeditions. Putties are, however, often worn even for an ordinary climb; since they tend to stop the circulation they must be used with caution in very cold weather. If for big snow mountains, the pattern with spat keeps the foot warmer, and can be kept tight on the boot by a bit of stout string passing under the instep. This is easily replaced when worn. If an ordinary puttie is worn, it is best, in order to prevent the end slipping loose on the greasy upper of the boot, to have a large size of hook ('hook-and-eye' pattern) sewn to the end of the puttie. This can be hooked into the lacing of the boot at the start of the winding. A good gaiter is the old-fashioned buttoned gaiter to come well down nearly to the toes, made fairly loose of *unlined* loden, kept in position by bits of stout string attached to leather lugs sewn *outside* the lower edges of the gaiters, on each side, the string passing under the waist, and brought over to tie on the spat, which is thus kept in place and prevents any snow working up. Such gaiters are warm, light and effective.

Clothes. The coat should be of stout tweed. I use a specially made 'Double Twist' Scotch Cheviot, treated with alum, which renders it showerproof. The coat must button up tight round the throat to exclude driving snow. The sleeves must be made with gussets like shirt sleeves, so that one can lift one's arms without stirring the body of the coat. This is very important when climbing rocks and step-cutting. A belt to the coat is a nuisance.

No lining whatever, except a bit of woollen lining to protect the *outside* of the arm from shoulder to elbow—not even padding or stiffening pieces. Four outside pockets, *all unlined*, and all made with flaps and buttons. Two large inside pockets with flaps and buttons. The pockets should be rather larger at the bottom than at the opening. If safe pockets are desired, to protect watch or glasses on severe rock-climbing, small pockets with flaps should be placed inside and high up, almost under each armpit.

The coat should be made double thickness of cloth on the front, and should be perfectly loose everywhere.

The buttons should be closer together than usual, so as to keep out driving snow.

The lower pockets should be set high enough, so that when full they do not catch in the groin when mounting steep slopes. The sleeves must have a second button to button tight round the wrist in storm.

Such a coat, if taken off now and again and shaken, will stand quite a little rain, and will in any case be lighter and *dry far quicker than a lined coat.* Pin half a dozen stout safety pins under the collar.

Waistcoat should be of the same cloth throughout, *including the back—unlined throughout*—made rather longer than the ordinary waistcoat, especially at back—no back strap—four pockets outside with flap and button—all unlined—one inside pocket with flap and button for letter-case. Collar to button close up.

Knickerbockers of the same cloth, made very long in the seat so that they do not catch at the knee when mounting steep slopes—waistband to be unlined—two outside hip-pockets with flap and buttons besides the ordinary pockets—to be made wide at the knees, but the width to be on the outside of the knee, as if on the inside the crampons are apt to catch. The riding-breeches pattern is no good, as the knees get wet much quicker and remain wet longer.

I myself have my knickerbockers made wide enough to turn right up over the knees, being kept there by safety pins; one walks thus bare-kneed with great ease and comfort.

The seat and knees may be made double by means of patches. Pin half a dozen stout safety pins in the waistband.

Hat.

The best hat is a grey or buff stout felt (unlined) 'smasher' hat—medium width brim and with a felt Jäger lining-band instead of the usual leather one. If too thin, the brim flaps about in the wind and needs pinning back with a safety pin. Fit a 'sweat-band' of oiled silk under the lining band, to prevent the hat getting stained with sweat. The cow-boy pattern with stiff brims does not do, as it is apt to get knocked off by contact with rocks, and one cannot sleep in it. Carry some sort of light cap.

Shirt, etc.

The 'K' or 'KK' Jaeger shirts answer well. Their short 'G' pants also answer well. No undervest should be worn.

Remember, if you do not want to feel cold, avoid getting hot.

The proper place for the coat, except in very cold weather or on difficult work, is over the shoulders or in the sack, the sleeves being tucked through the shoulder straps. Even when starting very early do not pile on clothes.

Carry a light woollen sweater and a very light woollen muffler, about one foot wide and six feet long at least. In very cold weather, or if sleeping out, pass this tight twice *round the stomach* and fasten with safety pins. Carry two or three large silk handkerchiefs. The coat, sweater and a silk handkerchief will protect the throat enough.

Extra Clothes.

Keep your stomach warm, as it furnishes the heat to the rest.

Carry a light waterproof cape. They are obtainable at Fritsch & Co., Zurich, made of Japanese silk—cost about 30s., weight about a ½ lb. They save one the annoyance of getting wet going up to a hut or bivouac or in the valley, and are useful in the case of an impromptu bivouac, as they keep off the wind. They cannot, of course, be well used when climbing.

Carry a light woollen helmet or *passe-montagne* to come right over the head and neck, with opening for eyes, nose and mouth.

Carry, *without fail,* an extra pair of stockings a bit thinner, since weight counts, than your heavy climbing stockings, but strong enough to use in an emergency or to change if benighted. And it is also very desirable to carry a light spare shirt on long-exposed expeditions.

Carry two pairs of gloves made of coarse, thick wool, without separate fingers and amply large. They should also be long enough to cover the wrist of the sleeve. Short gloves are useless. Pin each pair together with a safety pin. Carry one pair at the bottom of the sack, the other pair in the outside pocket of the sack. A pair of mittens is useful.

Captain Farrar allows me to insert some suggestions on an alternative dress suitable for men sensitive to sudden changes of temperature.

Some Alternatives (by G. W. Y.).

THE COAT.—Unlined except for the lining on the outside of the arms, before mentioned, and a single strip of loose Jaeger fabric, stitched only at the upper edge and ends, across the shoulders. I prefer also

a lighter material, very close woven, for both coat and breeches. Heavy friezes, as often worn, absorb wet and admit wind as the fabric slackens with wear. So-called 'tropical' and 'waterproof' materials dissolve like paper on rough rock work. The collar turns down well away from the neck, and, when needed, buttons in front with a flap which is sewn on to the coat, under the collar, along its *lower edge*, so that when buttoned up to the two sides of the collar the flap leaves no hole where snow or wind can enter.

For the Alps.

THE BREECHES.—Trousers, such as used to be worn, had the advantage of leaving the knee free; but they are uncomfortable with putties and clumsy at the ankle. Best of all leg-gear, in some respects, are the 'shorts,' as worn by the Tyrolese; but these leave the knee unprotected for rocks or against bad weather. I prefer a compromise: the breeches made loose to the knee, as above described, but the leg of the breech below the knee carried on and down, in the same material and shaped to the calf, low enough to be easily covered at the end by a sock. To allow passage to the foot, the extension opens down the *inside* of the calf, and is secured there by a row of four small press springs. Buttons or buckles at the knees are always breaking on rocks, and can be painful. Lacing is better, but apt to be too tight. One set of these small press springs, in spite of warnings, has lasted me for five years, without a single one coming open or losing its strength. They are, of course, well protected, as placed on the inside against the 'give' of the calf. The advantage of such long breeches is that they do not, like the usual type, constrict the knee or calf, and they do not, like trousers, drag over it, since the weight of the leg is partly carried by shaping and by the support of the sock. They are worn with socks and not stockings. This both economizes carrying and avoids the clumsy 'gump' where a puttie is twisted at its upper end over the stocking top. With two pairs of socks worn, one holding the end of the breech leg and one turned down over the boot, the climber need only put on the puttie for deep snow, or to protect the shin on sharp rocks. In contact with rough surfaces the cloth leg is, of course, more durable than any woollen stocking. They should be made ample between the legs, and the seam stitched

strongly and far up the front, closing with a flap or fob, as in riding-breeches. For snow, wind and wear this is a better protection than the usual single row of buttons. Two buckle-straps above the seat behind, the lower set rather far down and kept the tighter, enable one, if the breeches are well cut, to do without braces or belt. At the same time, they avoid constricting the waist or lower part of the lungs, as the line of tension, or close-fit, hangs thus round the outside of the hip-bone, and the waistband can be left quite loose.

UNDERWEAR.—I prefer, as an alternative to a shirt, two or three very light silky-woollen 'Shetlands,' opening down the front and sitting close to the body all the way. One at least should come right down to the thighs. The lowest, a zephyr or almost silk-web, with short sleeves; the second, an ordinary warm light Shetland, with longer sleeves over the elbow; the third, thicker, of looser fabric, with no sleeves. These can be thrown open, put on or taken off, one or more, in a few seconds, as the temperature varies. They dry at once, in wind or sun, or from the heat of the body, and are at once warmer, drier and less oppressive wear than a full absorbent shirt. I wear no waistcoat. A silk scarf is pleasant to the feel, and protective against sun or cold. I find the best and cheapest to be a yard and a half of silk motor veiling. This dries at once, and can be used for any purpose, from a sling to a turban or dressing-gown.

Corduroy or close-woven frieze provides the best wear. Coat and breeches should be *unlined*. The knees can be strengthened by a double thickness or by buckskin. In the latter case ordinary 'strapping' will do, set over and not inside the knee. It is well to have removable oilskin bags for some of the pockets, to keep food, etc., dry in rain, or, at need, to sit upon.

For Rock Climbing in Britain.

A sweater worn, as is often done, without a coat is a mistake. It catches on rocks, absorbs mist and rain, admits wind, and has no pockets. Experience teaches that the wet or windy cold of British hills can be far more trying than the dry cold of alpine days.

Boots may be lighter and more lightly nailed than for the Alps. For this see "Rock Climbing," p. 154. As they are liable to get over-wet on British hills, and over-dried and warped in British kitchens, it is well to have a

pair of very light aluminium toe-trees, adjusted to the size of the boot, which can be inserted the moment the boots are taken off in the evening. These serve to keep the shape.

Rubber or rope soled boots or shoes are now considered almost indispensable: made of light canvas, to go in a pocket.

Putties are superfluous; a light leather anklet, or a couple of feet cut off an old puttie and twisted round the boot-top, sufficiently prevents the entrance of small scree. For wear in snow, and this applies also to the winter snow of the Alps, it is a good device to have a narrow band of strong, soft material sewn on round the top of the boot, which laces up, close round the ankle, in a line with the bootlacing. This is adequate protection for all but prolonged snow wear.

A good British head-wear is a strong tam-o'-shanter. It is better wind and rain protection, and cooler, than a cap, and leaves the forehead freer than a felt hat. Best of all is no head-gear at all.

For those whose hands suffer from cold on wet rocks, or who, like myself, have once had their fingers frost-touched, some sort of gloves are necessary. In rock climbing, gloves, and still more fingerless 'gubs,' destroy the touch and grip. I find the best compromise to be strong woollen finger-mittens, with fingers extending as far as the first joint. Some climbers profess to get comfort from warming their fingers (and thawing out their rock holds) with the small pocket Japanese 'Instra.'

It is well to have everything *marked*, or of distinctive colouring. In Britain, the orgies of the 'drying-room' are a daily trial to temper and time.

It is well also to remember that, in all mountaineering, we are to form the foreground of our companions' holiday views of great scenery, and that it is our duty not to inflict a larger proportion of the incongruous or ugly upon their daily outlook than is required by the first condition of our own comfort and protection.

Women have learnt by experience that convention must give way to common sense in the matter of costume.

For alpine work, clothing should be entirely woollen; the suit, comprising coat, breeches and skirt, of light

weight and colour, and—this is essential—wind-proof. For British climbing, gaberdine or cord can be substituted for wool, as, here, protection against rain is of more importance than protection against wind. The coat should be shaped like a man's jacket, furnished with an adjustable collar, storm sleeves, and an ample supply of pockets, closed by flaps. It should be of such a length as to reach within eight inches of the knee.

Costume for Women (by Miss Bronwen Jones).

The skirt is still often looked upon as a necessity in the Alps, but it is discarded early in an ascent. It should therefore be of a soft and light material, so as to be easily carried in a rucksack. It should stop at least ten inches from the ground, and be not more than two yards wide.

The breeches should be as close-fitting as those of a man, as over-fullness is apt to be a hindrance on rocks. They should also be laced rather than buttoned at the knee, buttons being a source of discomfort when kneeling.

A sweater is generally preferred to a blouse for wear under the coat, as it is loose-fitting, warmer and does not impede the movements of the arms.

The most suitable hat is made of either grey or white soft felt, wide enough to provide a shade from the sun. A stiff brim should be avoided on account of the discomfort caused by its coming into contact with the rope. Hatpins should obviously be replaced by an elastic.

It is not advisable to wear gloves for rock climbing, as they lessen the sense of touch. Woollen gloves, with no divisions for the fingers, are recommended for wear on snow or when stationary.

A silk scarf, tied tightly over the hat, has been found a great boon during high winds in the Alps.

Boots, stockings, etc., are the same as those advised for men.

In order to avoid great subsequent discomfort, the face and neck should be carefully protected against sunburn. For this purpose an even layer of some good colour salve is most effective. Failing this, a layer of lanoline covered with toilet powder has proved a fairly good substitute. A small pocket-mirror should be carried for use when applying the mixture, so that one can see that no place is left uncovered. Should the face become sunburnt it should be bathed in very hot water and then covered with grease.

Outfit

BY J. P. FARRAR

Even the beginner had better accustom himself to carry a sack, which may contain his gloves, sweater, etc.

Rucksack. A good size is 21 inches wide and 21 inches deep, the bottom and side walls 4 inches wide, as this gives a flatter sack. Two outside pockets with flap and button—the carrying straps of woollen webbing 1½ inch wide—the whole made of waterproof sailcloth with a flap. A good pattern is supplied by Alpine outfitters such as Fritsch & Co. of Zurich, who issue elaborate catalogues of alpine equipment. The Continental dealers supply a very light frame which goes between the back and the sack, thus preventing the back getting hot. The best I know is the "Touristenfreund Rucksackstütze," No. 20, 3½ marks, supplied by Fritsch. The Norwegians make a novel kind of sack, the weight of which is carried partly by the hips.

Ice-axe. The best ice-axes I know are made by Schenk in Grindelwald (difficult to get delivery). The same pattern is also made by Fritz Jörg, Zweilütschinen, near Interlaken, from whom I have had several good axes. It is necessary, however, to specify the pattern, as he makes several. Sizes are as follows :

Length of adze-side of head from centre of handle	5″ (12 cms.)
Length of pick-side of head from centre of handle	7″ (18 cms.)
Width of blade of adze	2½″ (6 cms.)
Depth of socket of head (to give weight)..	2″ (5 cms.)
Length of side irons of head from lower edge of socket	7″ to 8″ (about 20 cms.)
Side irons should be fastened to the stock by 3 copper rivets, not screws.[1]	
Length of ferrule of axe handle	2½″ (6 cms.)
Length of point of axe handle	2″ (5 cms.)
The point must not be sharp, and if longer than stated, may tear one's clothes when cutting. The point and ferrule made in one piece are very objectionable, as they allow the point no play if caught.	

[1] See article in the *Climbers' Club Journal*, 1912, p. 147.

Length of stock or handle, including point 39″ (1 m.)
This is a good average length for general purposes. Longer axes offer no advantages, and are awkward. I use a 36-inch axe, which is very handy, but it is short for cutting downhill.
Diameter of handle immediately under socket of axehead .. $1\frac{1}{8}$″ by $1\frac{3}{8}$″, say 30 by 35 mm.
Diameter of handle immediately above ferrule .. .. .. $1\frac{1}{16}$″ by $1\frac{5}{16}$″, say 27 by 33 mm.
These sizes give strength enough. If exceeded, they fill the grasp of an ordinary hand so that, as is often needed, nothing else can be gripped. If the lower end is thinner it will cramp the hand when cutting.
The axe should balance at about 9 inches from the top.

An axe as described weighs 3 lb., and will be equal to any work usually met with on a mountain expedition. If the balance and the curves of the head come out well, it will cut ice clean and without any recoiling jar to the arms. Notches on the underside of the head of the axe, often seen in shop axes, are very objectionable.

Mr. Eckenstein has designed an ice axe differing radically from the normal type, to be used in conjunction with his crampons. It is 34 inches long over all, and has a much smaller head. The few who have used it in conjunction with the special crampons claim for the combination advantages in difficult ice. The subject has been treated by Dr. J. Jacot Guillarmod in an elaborate paper with scale drawings and many sketches in the *Jahrbuch des S.A.C.*, vol. xlv. pp. 344-53, and undoubtedly deserves the closest attention.[1]

This axe, and crampons, are made by A. Hupfauf, Einsiedeln, Switzerland.

[1] See also pp. 206, 292.

FIG 1.—THUMB KNOT. CORRECT

FIG. 2.—INCORRECT

FIG. 3.—FIGURE OF 8 KNOT. CORRECT

FIG. 4.—FIGURE OF 8 TIE. CORRECT

When climbing rocks the axe has often to be slung on the arm. A good sling for rocks only is made of lamp wick joined to form a circle of 25 inches. This is carried in the pocket, and is easily put on and off. The fixed hemp sling, so often seen, gets wet and cut if any steps have to be cut.

Axe Sling.

The best combined sling, invented by Mr. V. Fynn, and supplied by Fritsch & Co., Zurich, consists of a leather loop attached to a brass ring running on the axe handle between the head and a stop. This sling serves for rock work like an ordinary sling, and, in addition, is looped round the wrist when step-cutting, thus preventing the loss of the axe, which to a party of climbers engaged in difficult work might be a source of danger. I always use it.

The greatest attention must be paid to ropes, as fatalities due to the breakage of these have been very numerous.

Rope.

I was, in consequence, induced to institute some very careful inquiries into the question of the most suitable ropes for alpine work, and some very exhaustive tests were thereupon made of various ropes by Mr. O. Eckenstein, which have been confirmed by subsequent tests made by Swiss climbers. The result was the evolution of a flax rope, which, in point of ultimate tensile strength and extension (i.e. elasticity), surpasses considerably any other rope, weight for weight.

The following table gives the ascertained results of the two best ropes tested:

Make.	Circumference, in inches.	Weight per 100 feet, in pounds.	Ultimate tensile strength, in pounds.		Extension, measured on test length of 5 feet, per cent.	Work required to break test length of 5 feet, in foot-pounds.	
			Absolute.	Relative, for rope of standard weight.		Absolute.	Relative, for rope of standard weight.
No. 1.—English, Flax. . .	1·4	4·375	1904	2176	16·3	451	515
No. 2.—English, Manila . .	1·4	4·65	1792	1927	12·3	331·5	356
No. 3.—No. 1, worn . .	1·4	4·69	1456	1552	13·2	288	307

The No. 1 rope is manufactured by Frost Brothers Ltd., 342 Commercial Road, London, E., and is known as Frost's left-hand alpine rope, 1¼ inch.

It is beautifully flexible to handle and knot, and after the first wetting shows no tendency to kink. I do not know much of its wearing capacities—in this respect it is probably excelled by the harder Manila ropes. For the haulage of duffers where the rope is constantly dragged against rocks, no doubt a much heavier rope of Manila or possibly wire would be preferable. The Frost rope now described is designed for the use of trained mountaineers. All that I demand and all that ought to be demanded of an alpine rope is that it shall not show undue wear during a single season.

I never use for a *second* season a rope on which life may depend when a new one can be obtained for a few shillings. Even when a rope shows no appreciable wear, it may have been subjected to some sudden severe strain which has robbed it of a portion of its virtue. I go so far as to say that used ropes ought *not* to be given away to guides who will go on using them for an indefinite time.

The No. 3 rope in the table was a Frost rope used by the late Mr. H. O. Jones for one season. The decline in its resisting power is marked, although it is still a fairly strong rope.

Knots.

With respect to knots for use in alpine ropes, Mr. Eckenstein was again good enough to investigate the question, and the accompanying illustrations have been prepared from photographs taken under his instructions. They are all applicable to a *left-hand rope.*

The following is an extract from his covering letter to me :

" A laid rope usually consists of three strands twisted together. Each strand thus forms a helix. The strands are ' laid ' together to form the rope, and the way in which they are laid together is called the ' lay.' Now if we begin to tie a knot, we similarly ' lay ' together, two ropes, and each rope then forms a portion of a helix. The general rule is this : if the strands of the rope used form right-hand helices (as is the case with the

FIG. 5.—SINGLE FISHERMAN'S BEND. CORRECT

FIG. 6 —INCORRECT

FIG. 7.—INCORRECT

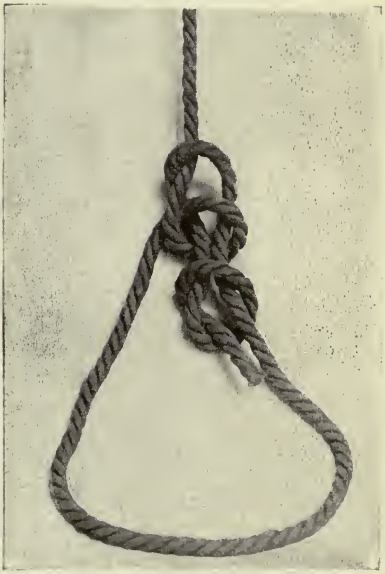


FIG. 8.—BOWLINE AND OVERHAND KNOT. CORRECT

old Alpine Club rope), then in that part of the knot which is subjected to the greatest strain (I use the word 'strain' in its popular sense) the two ropes must each form a left-hand helix. Conversely, if we use a rope the strands of which form left-hand helices (as is the case with the new Frost rope), then in that part of the knot which is subjected to the greatest strain the two ropes must each form a right-hand helix. [See also my paper, "Knots with the Lay," in the *Climbers' Club Journal*, vol. xi., No. 44, p. 144, June 1909.]

"The annexed figures include three classes of knots: simple or elementary knots; knots for uniting two ropes; loop knots. All are shown tied with left-hand rope. The correct way of tying the knots is shown in each case, as well as some incorrect ways. Each knot is shown open, before it is drawn taut.

"The single fisherman's bend, shown in Fig. 7, is excellent for uniting two ropes of similar size for temporary purposes, as it can readily be undone. Hence it has a tendency to work loose in course of time, and if it is necessary to unite two ropes of similar size for longer periods, it is better to use the figure of 8 tie, also known as the Flemish tie, shown in Fig. 4. This, though somewhat complicated, is strong and reliable and has no tendency to work loose.

"As regards making a loop in the middle of a rope, no entirely satisfactory knot has yet been devised. The 'middleman noose,' shown in the 1892 Alpine Club Report of the Special Committee on Equipment for Mountaineers (p. 4), has the fatal disadvantage that under certain conditions, when a pull is applied in a certain direction, it acts as a true noose — that is, as a slip or running knot. The best middle loop at present known is the open-handed loop, which is free from this disadvantage, and which is shown in Fig. 14.

"For an end loop, the bowline, shown in Fig. 11, is excellent. The loose end should be secured by a half-hitch (see 1892 Report, p. 4), or by an overhand knot; the latter, shown in Fig. 12, is preferable.

"Finally, a bowline on a bight, the most important 'first aid' knot for transporting an injured person, is shown in Fig. 16."

Messrs. Kirkaldy made in my presence some interesting tests of knots, with the following results :

Middleman Knot.	Strength relative to rope.
Manila rope	44 per cent.
Flax rope	50 per cent.

Single bowline Knot.	Strength relative to rope.
Manila rope	55 per cent.
Flax rope	59 per cent.

This again shows that a knot reduces the efficiency of a flax rope less than that of the Manila rope.

New ropes should not be wetted or stretched before use, but the kinks should be carefully worked out by hand. And a wet rope must be dried *in the shade.*

The best length of rope for a party of three is 100 to 120 feet. It is a good plan on long, snow-covered glacier expeditions to carry a spare 50-foot rope, and on some difficult rock climbs a long spare rope is necessary. This can be of a lighter kind, about 1 inch circumference. Beale, 194 Shaftesbury Avenue, London, supplies a Manila alpine line very suitable for such a purpose.

Pitons.

Pitons are occasionally necessary for difficult rock climbs.[1] They are spikes of Swedish iron ½-inch in diameter and about 6 to 9 inches long, turned over to form a loop at one end, through which the rope can be passed, and drawn at the other to a wedge-shaped edge so as to allow of driving into a crevice of rock.

Kletterschuhe.

Kletterschuhe are much used in the Dolomites, and it has lately been shown that they can be used with advantage not only on dry rocks but also in great climbs like the Ecrins and the Aiguille froide. A good kind is the so-called Sexten pattern, the soles of which are built up of layers of cloth.

Crampons.

Crampons add security, and are very useful in saving step-cutting on great ice climbs; but otherwise, especially on journeys, are scarcely worth carrying. Mr. Eckenstein has designed a very effective kind, the only drawback being their weight (about 3 lb. the pair). A useful crampon is the so-called Allgäuer model, 8-spiked, weight about 1⅝ lb. per pair. A. Hupfauf of Einsiedeln, Switzerland, is a reliable

[1] See " Pegs and Aids," p. 200.

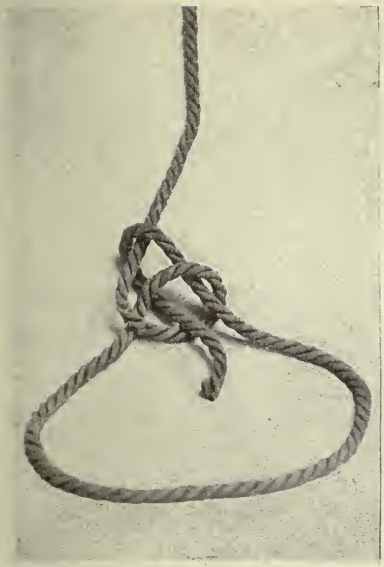


FIG. 9.—BOWLINE. CORRECT

FIG. 10.—INCORRECT

FIG. 11.—INCORRECT

FIG. 12.—INCORRECT

maker (also of ice-axes if pattern is sent). The crampons should have a hemp strap with branches sewn on to the two pairs of back rings and buckling over the instep, and a separate toe-strap sewn on to the front pair of rings and buckling over the fore-foot. This strap must not be buckled tight, as hemp shrinks when damp, and pressure might cause frost-bite.

This form of fastening (as on the old wooden skate) cramps the foot less, and is much more quickly adjusted than a single long cross-over strap. The crampon requires careful fitting to the sole of the boot (a stiff cardboard template of each sole should be sent to the maker of the crampon), and when nailing the boots, gaps should be left for the limbs of the crampons.

In using crampons care must be taken to keep the feet apart and not lift them more than necessary, as serious accidents have occurred through the spikes catching in the stockings or even knickerbockers.

Crampons are not for use on rocks, except possibly when iced, but they are particularly necessary on steep grass mountains, like the Höfats.

Spectacles and Grease.

Both spectacles and grease are very necessary on glacier expeditions. The spectacles can either be smoked glasses or, better still, the new green-yellow glasses. I prefer 1½-inch convexo-concave glasses in strong steel or horn frames without any wire netting.

The best grease for the face which I know is the Pomade Sèchehaye; but there are other similar preparations which rightly depend upon colour for their effectiveness. Lanoline is too thin. Blackening the face and all round the eyes with burnt cork is also an efficient remedy against sunburn, and suffices in the case of loss or breakage of spectacles. Or a mask of paper, with eye-slits, can be made.

Field-glass.

A Zeiss 8-power *monocular* prismatic glass weighs about a ½ lb., and can be carried in the pocket without any case for instant use. The binocular glasses are too cumbersome.

This glass can also be used for sweeping terrain for chamois, but for detailed work a 30-power aluminium telescope is better.

Less effective, but lighter to carry, and sufficient for most alpine prospecting, is the pocket telescope,

made by Messrs. Ross, for sporting purposes. It is about 4 inches in length, and weighs only a few ounces.

Good mountain aneroids, graduated to 5000 metres, are made by Casella, London, and by Usteri-Reinacher, Zurich. Even on an ordinary expedition they are interesting, and can be useful to elucidate one's position in thick weather.

Aneroid and Compass.

A compass must always be carried. Hughes, 59 Fenchurch Street, E.C., make an excellent liquid-filler compass which renders the needle very steady.

The best map of the district must always be carried with the party.

Maps.

I have for many years used bottles made of Para rubber with wide (1¼-inch) mouth and screw stopper. Contents 1 litre, weight 6 ounces, price 6½ marks (H. Schwaiger, Munich). If cured for a few days with weak white wine and water or coffee they do not impart any taste to contents, even if left in for a couple of days. When empty, they take next to no room.

Water-bottle and Drinking-cup.

The full bottle must, of course, be perched on top of the other things in the sack.

Guides prefer a tin or aluminium receptacle to hold two or three litres, and the goatskin bottles usual in Dauphiné are also very practical. As a drinking-cup I know nothing better than the ¼-litre oval aluminium mug of the Federal troops.

Carry an aluminium dessertspoon.

Several patterns of folding lantern are made. Schwaiger supplies one in aluminium (Alpenvereins), weight 6 ounces, price 6¼ marks.

Lantern.

I have never carried cooking apparatus, as cooking on an expedition takes far too long and is a needless luxury. A good one is the Ideal-Kocher in aluminium supplied by Schwaiger and others, size 1 litre, 6 marks; 2 litres, 8 marks. They are useful for guideless climbers in crowded huts.

Cooking Apparatus.

It is not at all a bad plan to carry an aluminium saucepan with lid (about 1 quart), which will often enable one to cook in a crowded hut without waiting one's turn. For a bivouac, a couple of aluminium saucepans fitting into each other save carrying heavy cooking pots.

FIG. 13.—OPEN-HANDED IKOF. CORRECT

FIG. 14.—INCORRECT

FIG. 15.—BOWLINE ON A BIGHT. CORRECT

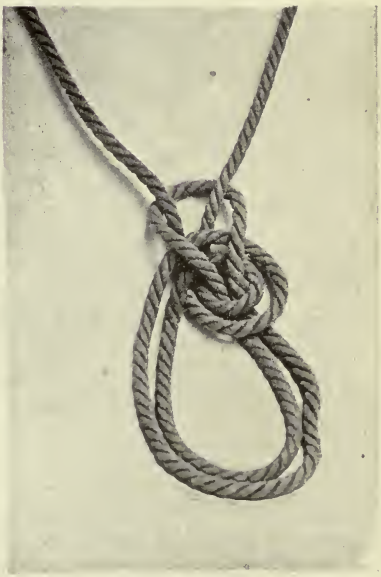


FIG. 16.—INCORRECT

Outfit for Bivouac.

The best sleeping sack I know is made of thin Willesden canvas lined with opossum. The sack should be made to button all round—not sewn. A suitable size is 6 feet 6 inches long and 2 feet 6 inches wide when done up. Opossum fur is, however, now expensive, and a very efficient lining is eiderdown made up in thin merino covering. W. Ratcliff, saddler, Olney, Bucks, can supply a good sack, made with straps to roll up, cost £3 to £4, according to the weight of down used (price pre-war). A light silk sack is made by Heal & Sons, Tottenham Court Road, cost £2, 10s., but requires a waterproof sheet.

For putting under the hip, a square rubber air-cushion about 2 feet square is very desirable.

A tent is rarely necessary for a bivouac for one night, as if the weather were bad enough to need a tent, the conditions next day would not permit a big climb. The Mummery silk tents are well spoken of. A light tent of the Mummery pattern, tested and improved upon by Dr. Longstaff in the Himalayas, and with further improvements by Mr. Young, is made by Messrs. Piggott, Bishopsgate Street Without. The Cottage tent of the Amateur Camping Club, London (address, 4 New Union Street, E.C.; sub., 5s. per annum), is very light, roomy and strong. Their catalogue is well worth study.

For extended expeditions I have used a tent made of Egyptian flax, so-called silk. A good size is 9 by 6 by 6 feet to ridge, or better, 12 by 8 by 6 feet to ridge, unless the country is too mountainous. It only needs two poles, which can in some countries be improvised on the spot; or the ridge cord can be tied to trees or other obstacles, and poles dispensed with. These tents are quite waterproof and stand weather well, whilst they are very light.[1]

One's endurance and enterprise are not improved by sleeping on the ground, even on spruce, night after night. The X Compactum bed is a good portable bed, folds up to 3 feet by 5 inches by 5 inches, weight 20 lb., cost 24s. 6d. This, with a sleeping sack, a couple of Hudson Bay No. 4 red blankets, a waterproof sheet 7 feet by 5 feet and a hair pillow, make a good sleeping outfit for a main camp.

[1] See also "The Himalaya" and "Mountaineering in the Tropics."

For alpine purposes I find chlorodyne, Cockle's pills, a couple of bandages and a roll of ½-inch American plaster very useful to carry in the sack.[1]

Medicine.

Small and very light pocket-cases, suitable for mountaineering purposes (one of medical and the other of surgical remedies), are now supplied by Messrs. Burroughs & Wellcome.

These notes cover the *special* requirements of the mountaineer in the Alps, and I have not thought it necessary to enumerate the many small things which he needs anyhow, and of which he is the best judge.

Note.—All prices are pre-war except where stated.

---

[1] For further medical outfit, see "Mountaineering in the Tropics."

CHAPTER III

GUIDED AND GUIDELESS MOUNTAINEERING

THE question of climbing with or without guides is one of traditional importance. But the long controversy has proceeded without taking into account the change in modern conditions; and the terms 'guided' and 'guideless' are still used with a signification that now bears little relation to actual circumstance. Consequently the discussion for mountaineers has become profitless, for it is based upon definite misconceptions.

Old-time Errors.

The great public, or that part of it which has reached the point of accepting mountaineering as a legitimate background for sensational magazine stories, cherishes one fixed idea on the subject of climbing—that the guide is a providence who knows and shows and goes the one sacred and impeccable 'path' which every genuine mountain possesses: to go without him is to tempt destruction deliberately; something like ejecting the engine-driver, starting the lever and retiring to smoke in a first-class carriage. The importance of the error is that its persistence permits it to dominate the minds of a large number of men who 'do mountains' every year from the hotels. To them, mountaineering means only the traditional route up in the traditional way; and tradition demands the surrender of their intelligence and personal inclinations for a day to the unimaginative tyranny of any two chance peasants between whom they are advised to suspend the exercise of their own finer faculties and the direction of their very differently constituted frames. Their ambition is laudable, but they are in no sense mountaineers, and they may never become so, any more than those who cross the Channel in a steamboat are qualifying as sailors. But they form a considerable

portion of those who go among the mountains, and include a large number of those who give the public their experiences. In so far their patronage contributes to confirm and perpetuate the long-lived error.

Among a large number, also, of climbers proper the error, though different in kind, is as constant. The magnificent school of foreign rock climbers which has of late years grown up in the regions of lesser peaks north, east and south of the Alps, and which, with some notable exceptions, has little conception of what independent mountaineering on the great peaks means, accepts the performance and narration of these tourists in the big Alps as typical of 'guided climbing,' and very justly condemns it for its obvious lack of many of the features which constitute the pleasure or merit of their own mountaineering. In so far as they accept the popular and mistaken classification into guided and guideless, these climbers help in continuing it. Our equally brilliant school of British rock climbers, recognizing the absurdity of taking guides on the short climbs of Scotland or the Lakes or Wales, often adopts the same attitude. Only by slow experience, and in individual cases, when they meet the problems and actual conditions of real mountaineering in the great Western Alps, do they learn the magnitude of the traditional fallacy. There is, therefore, excuse for the Press and the lay public.

There is yet further justification to be found for them in the only literature accessible to them—the famous alpine classics, and the original relationship of amateur and guide therein set forth. We mountaineers owe so much to these early explorers and to their inspiring records, which first set our feet on the mountain way and which remain our most cherished and revered companions, that it is an ungrateful task to have to forsake them for a moment in the interests of veracity and of our modern mountain craft. But many of these notable pioneers, or at least those whose personality is most permanent in literature, were not mountaineers in the technical sense in which we understand the word to-day. Mountaineering, as an art, has made immense strides among amateurs and professionals alike since their time, due largely to the force of their original impulse. What was true of their

The Guide of the Chronicles.

time is no longer true; and while their writing will remain the source of every climber's inspiration until mountaineering may be forgotten in the passion for winter sports and aviation, it is not in the best interests of the sport that their pronouncements should be considered as absolutely or, even on technical points, as relatively true of modern conditions. They were undoubtedly fortunate in their guides. When they were not, we do not hear of it, or only in a passing sentence. The amateurs were themselves few in number, and the most enterprising naturally attracted to themselves the few considerable personalities among a race of as yet unspoiled mountain peasants and hunters. They found them companions, men of intelligence, manners and courage. The knowledge of mountaineering conditions was in its infancy, and the peasant was accustomed from childhood to such knowledge as existed. Relatively to the present day he was better physically equipped than his employer, who was primarily an explorer or a walking enthusiast. He was therefore not undeserving of the implicit confidence placed in his judgment and skill.

The Guide as he is.

Conditions have changed. Guides have no longer the opportunity of travelling up and down the Alps to secure the same wide basis of experience. Only a few of them are taken beyond their own valleys; and when they are, they are associated in most cases with local experts, who relieve them of the necessity of exerting their brains to discover the new conditions. Only in very rare cases among their multiple employers do they ever get the same opportunity of long contact with more active or educated intelligences, such as could react upon their own appreciation of their own mountain problems. The organized conditions for tourist life in the Alps, the separate quarters in hotel and hut, the rapid succession of engagements with men of different nationalities and divergent types, and their own guide-schools, inculcating precise codes of manners to use with 'Herren,' forbid the old freedom of intercourse. The best and most travelled of guides has a different manner on the mountain and in the hotel. There is no authority so absolute as that of the hotel-keeper in a small democratic Swiss community in all that affects the tourist traffic. And the ideas of an

average hotel-keeper as to the nature of tourists and as to the proper behaviour towards them on the part at least of his, the hotel-keeper's, dependents or inferiors are not unlike those of a head waiter in a city restaurant. The tradition that the guide is a professional servant has become engrained. The stoutest of mountaineering democrats has to accept its restrictions, once off the mountains, if only to save his guide's discomfort. And the average guide on his side, dealing every summer with succeeding varieties of incapable amateurs often ignorant of his language, and accustomed to the passive acceptance of his service to hoist them up conventional peaks, has grown up in a traditional atmosphere of aloofness and of courteous disregard for his employers as mountaineers in his own professional sense. A collective professional attitude has established itself of which the early days knew little or nothing; the most independent of guides, however well he may know his employer's capacity by experience, cannot but find the utmost difficulty in discarding tradition and associating himself with the amateur's judgment if it happens to conflict with local hear-say or with the view of some inferior professional using the familiar patois. And just in so far as a collective opinion, in theatre or crowd or guild, is inferior to the individual judgment of the majority of intelligent individuals who compose it, and echoes, as if unanimously, the more blatant voice of the more vulgar elements, in so far is the capacity, even of good individual guides of the present day, inferior to that of their predecessors in matters requiring the exercise of wider intelligence upon unforeseen problems or new conditions. Just in so far, also, are guides hampered by their body of tradition and prejudice from profiting by their contact with more educated minds, or from learning to apply new principles to the special circumstances of their profession. With the formalizing, even in details, of the route up every regular peak, the stimulus of romance and adventure has gone for them far more than for the amateur. The new generation finds its only outlet in the autumn chamois-hunting, if at all. Its mountaineering is just business.

There are some rare and notable exceptions—perhaps as many in actual number as formed the chosen band of guides who led the early mountaineers in their pleasant

comradeship of triumph—but they are attached in almost all cases for each season to affectionate and jealous employers, and for the general mass of climbers there exists only a general mass of guides of the limited and professional cast of mind. In continuance of early pioneering tradition some great amateurs of the old school still maintain that the guide's word should be law in all tactical and even strategical decisions. These are the fortunate men, whose knowledge and reputation can command the services of the surviving body of exceptions. If they were not so fortunate, they would have to reconsider their view, or they would, at the present date, see more of hotels than of huts, of pastures than of peaks.

The Amateur as he may be.

If guides have, as a whole, not progressed in the responsible and sympathetic qualities essential for management, amateurs have improved out of all proportion. Mountain craft, the mastery of the laws that govern ice and rock and of their application, has become an exact science, and the educated intelligence, under right guidance, is able in a season or so to enter upon a whole inheritance of knowledge, of detail and principle, which it took decades of tentative experiment to discover. In the matter of purely technical skill also, of physical performance, of balance, the use of the feet, of the axe, the rope and the eyes, the phenomenon common to all sports has made itself evident: each new generation of climbers appears to inherit, almost as an instinct and without visible or conscious study, a greater adaptability, an easier apprehension, as it were, of the necessary and improving physical adjustments which had to be laboriously acquired by the previous generation. Consequently the good amateur now brings to the partnership a mountaineering qualification unimagined fifty years ago, possessed of an accumulated knowledge of all varying and recorded conditions and of a transmitted instinct for the novel athletic requirements.

In stating this, I do not wish for a moment to be thought to undervalue either the spirit or the skill of the few great early guideless parties who first broke loose from the growing oppression of the professional guiding traditions. They had to face a hostile criticism of whose intensity we have now little conception. In the then condition of mountaineering knowledge their independent

action, undertaken deliberately in the best interest of mountaineering as a great pursuit, postulated a resolute courage and a readiness for responsibility that proved to be as well justified by their record of performance as it remains deserving of our wholehearted admiration. The relations of amateur and guide would probably in any case have followed the same line of development. But these pioneers did more than anticipate. They first taught the amateur that it was safe for him, if he wished, to prosecute the craft for himself, and that he possessed advantages that could make him, if he followed them up independently, all but the equal of the best guides.

A guide is, in fact, only a 'guide' in the sense that he belongs to a professional class. The name can no longer be used to imply an inherent supremacy in all fields of mountaineering. Similarly an amateur possesses an inheritance and opportunities which make it possible for him to make himself as good as a guide in many, and better than a guide in several, important qualifications.

The Composite Mountaineer.

The title mountaineer can no longer be confined to the man of the mountains. It connotes the perfect mastery of a difficult craft to which guide and amateur alike aspire. This mountain science consists of several departments of equal importance, in some of which the amateur, in others the guide, starts with an initial advantage. In relation to its absolute acquisition there are bad professionals and medium professionals, and bad amateurs and moderate amateurs, according to their personal and not their class values. If they develop their experience and skill at an even rate, either will retain his initial advantage over the other according as the degree of difficulty or the special character of the climbing gives the greater opportunity to the special qualities of the one or of the other. Ultimately, in the highest flights of mountaineering, a point of difficulty is reached which calls for the highest degree of efficiency in all the departments; and since human endurance is limited and economy is essential for emergencies, the ideal combination for swift and secure progress in these ultimate expeditions is to be found in the association of the qualities of the guide and the amateur, each supremely qualified in his own department.

The Guide as Mountaineer.

A good guide is acclimatized, accustomed from his youth to the food, heights and discomforts of sleep. The necessary muscles have been hardened by years of practice. No average amateur, coming out for a few weeks each year and unaccustomed to manual labour, whatever his skill or talent, can hope to compare with him in endurance and consistent pace, be it in step-cutting for long hours on an ice slope or in facing struggle after struggle on an exhausting rock climb. The guide is inured to snowstorms and cold winds, and his fingers can usually outlast an amateur's in clearing out and clinging to snowy holds or iced rocks. He possesses thus more powerful reserves against unexpected bad weather or against unforeseen difficulty or exertion continued for an undue length of time. He has also another advantage. Amateurs who attempt big climbs are accustomed only to climb with safe companions. They have had, therefore, little practice in dealing with unexpected slips in easy places. Even if they have trained their observation and protective movement by leading beginners on British rock climbs, the duration of the attention demanded has been short, and they have known where to be on their guard, and with whom. But in the Alps the larger part of the day is spent in traversing comparatively easy ground well within the power of the party, but where the height and position may always convert an inattentive stumble into a fatal accident. A guide has been accustomed to looking after the unaccountable vagaries of beginners and incompetents over long days on easy and difficult ground alike. In his association even with a strong party this survives as an instinct. He is not caught napping by the misstep into which even fine amateurs or other guides in his party may be entrapped at the end of a long day by fatigue, wind, darkness or over-confidence. A good guide has, thus, special initial qualities which make him a sort of insurance policy in certain very important respects. His gifts reduce the percentage of accidental risk present on every climb, and his consistency of pace and endurance ensures a larger margin of time for emergencies. He can also carry more. He brings to the partnership physique, endurance, professional technique and watchfulness, and a local instinct for time or weather.

His opinion in his own sphere is invaluable; it has generally the additional weight of freedom from the enticements of romance and enthusiasm. The amateur in control should give it every consideration; but it does not relieve him of his own responsibility. A first-class workman may make a very bad managing director.

The Amateur as Mountaineer.

On his side the good amateur has antecedents and opportunities, such as the guide cannot possess, for developing his initial advantages in his own peculiar department. He has, or ought to have the superiority of the educated mind over the uneducated, of the liberal intelligence over the narrow, of contact with men, of reading, of the chance of learning principle and precedent from books and men instead of from small experience, and of the application of imagination and a trained mind to the acquisition of all the details of mountain craft. He can learn how to judge of the individual capacity of his amateur party and of their condition on the day. He can estimate the guide's ability in his own line, by comparison, better than the guide can himself, and from knowledge of his character he can judge of the value of the guide's opinion on technical points. In an important decision as to advance or retreat he is, consequently, in a better position to weigh the value of the party against the resistance of the mountain. In all that may be called the human department of mountaineering, the judgment and management of the men, the application of wider experience, of accepted general principles, of imagination and reasoning powers to the solution of particular problems, the good amateur is, *or can be*, the good guide's superior. He has also the advantage of being able to make up rapidly, by means of reading, imitation and the progressive adaptability already mentioned, much of his inferiority to the guide in pure technique. In route finding and local knowledge he can run the guide close by availing himself of previous records, of maps (always a mystery to most guides), of local information, of the tracks or presence of other parties, and of the admirable climbers' guide-books of all nations.

It is in fact no longer possible to designate climbing done under these conditions by amateurs of this class as 'guideless' climbing in the sense that climbing fifty years ago was entitled 'guideless' and looked upon as

unjustifiable. It is therefore easily to be understood that a large number of modern mountaineers, conscious of the amount of the field that their own qualifications and those of their party can cover, prefer to be free from any professional check upon their enjoyment of the mountains.

The Question for the Leader.

If good leaders know the power of their companions, where they fall short of those of a guide and how they can be supplemented, and if they choose climbs within those powers so far as is personally or climatically calculable, they have a right to decide whether the balance of pleasure and efficiency is on the side of using or of not using professional assistance, with its merits and demerits. There is an immense area in mountaineering where the special superiority of a guide in the directions I have indicated has no opportunity of making itself apparent. For the majority of difficult rock peaks, which are by nature short, for the ordinary route finding up big mountains, for the endless variety of climbing on passes and in regions of the lesser ranges, a first-rate amateur can make himself as effective as a first-rate guide. He can climb exhausting rocks as brilliantly, provided it is not for as long ; he can cut steps on the steepest ice only a little less fast, for a sufficient number of hours ; he can be as watchful on all but the most fatiguing expeditions. If the leader and party are efficient and know and observe their limitations, no mountaineer in more than name will now criticize them for going without 'guides,' even if the occasional accident, against which no knowledge is security, may in the course of time select their 'guideless' party for its undiscriminating attack. A mountaineer who has qualified himself as a good leader of a party as well as a sound climber has earned the right to weigh the social disadvantage of taking a guide against the technical strengthening his presence will contribute, in relation to the character of the climbing he intends to undertake, and to make his own decision.

The Social Consideration.

The technical advantage of taking a guide has been explained ; the social objection may be shortly stated. There is an inherent restraint upon the feeling of independence and holiday fun among a party of friends in the presence of

some one of foreign speech and of different habits of thought and body; above all, of one who climbs with them for pay and not for their common pleasure. The association is intimate in climbing, and the atmosphere is inevitably affected, and the spirits checked, if any one of the party is not in key with the rest, does not use their shibboleths or is unable to laugh with their jokes. When a party consists of more than one amateur, and often in the case of only one, etiquette usually insists upon a second guide being taken. If there is a second guide, a division into two camps is formed—one felt if not expressed—which no geniality or linguistic ability can dissolve. The second professional is nearly always, by the nature of the case, an inferior, more bound by his caste and with less interest in, because less responsibility for, the success of the party. He will generally voice valley prejudices and professional doctrines which are enemies to enterprise and individual achievement, and he will form a sort of unreasoning counterpoise to any effect that less hampered amateur opinions might otherwise have upon the views of the first guide. Situations are thus created whose solution demands more tact and attention than a man on holiday feels disposed to devote to his sport. The possibility of their occurrence forces him to put a constraint upon himself, in view of contingencies, which is antagonistic to the complete comradeship of mountaineering. He cannot, as the leader of such a party, merge his identity, and therefore his authority, in the pleasant fluctuations of the common mood. The association of guides also throws upon him many small additional details of daily management, if he is going to get the best use out of them and keep them in good temper. His attention to health, food, personal variations and humour has to embrace a whole new and foreign group of traditions and idiosyncrasies of which he has small experience. He has not only to attend to these, but also to bring them into harmonious co-operation during all the incidents of the day with the preferences, conditions and peculiarities of his amateur members, and with their—to the guides—incomprehensible ideals of adventure and fun. Other things being equal, a leader who knows that his party is competent should be free, on the ground of the extra call their presence

puts upon his management, to decide to do without guides.

But if he is not sure of himself, or if his party is unequal or inexperienced, he has no right to risk the possibility of disaster to his party and the certainty of premature grey hairs for himself by omitting to take a good guide on this social ground alone. And supposing him to be a man of conscience and competence, and not a reckless 'kraxler' of no mountaineering claims, he will not allow his decision to take a guide to be influenced by any fear that the credit of his party will be diminished in any competent mountaineer's eyes by the fact that a prejudiced or a thoughtless modern virtuosity might jeer at it as 'guided.'

The Technical Compensation.

In proportion as the collective efficiency of the amateur element is less, the necessity of taking a guide on the technical grounds described is emphasized. The good amateur, if he is alone in the Alps with one beginner or with two beginners, should certainly always take a guide. If he has one beginner and a man of second-rate skill or experience, he should in most cases take a guide; but something then depends upon the nature of the climbing he has in view. Similarly, if he is alone with a second-rate amateur, he should take a guide for glacier work and for all 'mixed' climbing, unless it be of a character to be well within the second amateur's powers as well as within his own. If he is aiming only at what may be called 'one-man climbs,' such as short, difficult rock peaks, his own skill may be considered adequate for the safe mastery of the difficulties, and the second man need only be responsible and capable of following without undue exertion to both. But in this case he must remember that he is making no allowance for accident, injury or the unforeseen.

Examples.

The Expert.

In all cases the first-class amateur remains the leader or manager of any party. He is always supreme in his own department of management; and the fact that the unequal or doubtful competence of his party, technically speaking, or the difficulty of the climb in prospect, may make it advisable to take a guide, and may render the party during the day more dependent upon

the guide's single contribution than would be the case in a party of more equal technical skill, should only be considered to give the guide a rather larger share in the general responsibility. The fact that a guide is taken does not justify the leader in throwing the whole responsibility upon him or in allowing his party to do so; and in the event of any unfortunate issue it will be no defence for his surrender of his proper functions in the eyes of good mountaineers that he is able to plead that he was technically 'guided.'

On the descending scale of climbing competence, when parties are in question which contain no first-class amateur, a guide is, of course, essential; and in this case his supremacy in skill, accompanied by any proportion of managing ability which he has acquired,—and which will naturally be greater than that of such inexperienced amateurs,—entitle him to all the control, and consequently to much of the responsibility which in former days used to be considered his alone in every department of mountaineering.

Such parties may be of three kinds: moderate mountaineers of some experience, who by choice confine themselves to modest climbs and wish to do them with the utmost security and the least personal exertion; beginners, who have still to learn all their business; and those tourists already mentioned, who merely wish to 'do a mountain.'

To take the last first, that of the tourists (and there are many of them), whose ambition it is to be taken up a big peak with a big name, without concerning themselves with learning anything of the craft. In such cases they do well to tie themselves between the strongest and most highly recommended peasants they can secure and leave everything to them. After the experience they will either desire to become mountaineers, when they will join the class of beginners, or they will desist. I should be the last to depreciate any manifestation of the spirit that has brought us all to the hills, but in this chrysalis condition their performance is not titularly mountaineering, and—it is bad for the guides! An occasion comes back to mind —an ascent of the Matterhorn on one of the two days upon which it was climbable in a bad season. Nine members of a far-western gymnastic club chose the

The Tourist.

same day for the one ascent of their lives. Each was led on a short rope by a more or less competent peasant. They climbed with a magnificent output of muscle. On reaching the summit, with its incomparable view and terrific memories, they looked neither down nor round, but joined hands in a circle facing inwards, and gave nine fearful and prolonged college yells. The bear-leaders, each gravely holding his separate radiating rope, stood contemplating them in a silent outer circle. The simple ceremony accomplished, each guide gave a solemn twitch to his spoke, or rather to his rope. The hub of the universe obediently dissolved itself, and the descent began. One wonders what passed through the guides' minds. If any of these men had been killed on the descent,—and it was a miracle in view of the condition of the mountain and of the way they climbed that they all escaped, with nothing worse than a night out on the rocks for seven of the couples,—popular censure would have spared their memories: they were not guideless. Whereas, if any one of our experienced and cautious guideless party had been hit by one of the countless stones with which the athletes converted the mountain side for long hours into an active volcano, there would have followed the inevitable outcry over "reckless guideless climbing"; not only from Press and public but even, I fear, from some of the guardians of ancient mountaineering tradition in our climbing associations. To the chance of this absurdity does the perpetuation of the outworn distinction between 'guided' and 'guideless' condemn any modern mountaineer of enterprise.

The Beginner.

Beginners call for more careful consideration, though they may be the least likely to be tolerant of advice. For I include among beginners not only those who have had no experience of adverse alpine conditions, but also all prophets who are in the habit of asserting that alpine mountaineering only differs from crag climbing in degree, as well as all climbers who, because their modern balance technique has proved sufficient to carry them through a season or so of standard expeditions in fair weather, consider themselves fully qualified to exercise all the discretionary functions of management and leadership without first learning them. Men are

all beginners who have never discovered what a lot there is that they do not know. There are men climbing in the Alps to-day who, finding that their first guide was inferior to themselves in pure cragsmanship, have dispensed with guides altogether; and a very slow progress in mountain craft and in achievement has been the result. There are also mountaineers, and good ones, whose competence appeared to justify them in doing without guides from the start, but whose brilliant performances are still marred by mountaineering errors which a more thorough grounding would have eliminated in time. Where the preparation has been deficient, management and leadership must remain voyages of unnecessarily slow discovery.

For beginners or ought-to-have-been beginners of these sorts I can only hope that the awakening may be as harmless, if not as prompt, as mine was in like case. Looking back from the summit of our second peak in our first season, I remarked to my single companion: "Look where that fool of a fox has run up our ridge all along the edge of the snow-cornice! And yet they say that animals——" And then I realized, with an amused horror that has never been forgotten, that we were looking at our own ascending tracks! Well; on the descent we found that, though we *had* ascended without a thought for cornices, we were equally in error on the summit in thinking we saw a cornice to the ridge over which our tracks passed! The next season we were content to take guides. So will any sage beginner in the Alps or other great range, if he is not fortunate enough, and few are, to be introduced to the science between two first-rate alpine amateurs.

If he is well advised, he will choose his first trainer as much for his knowledge of management—that is, his experience of amateurs, his power of estimating their potentiality and of encouraging their interest—as for his skill. Good second-class local guides in small centres, in contact with moderate but faithful local patrons, have often had more opportunities in this respect than more brilliant experts at large centres in constant engagement with changing employers. He should follow his trainer implicitly, note what he does and how he does it, and accept his judgments; but he should watch him persistently, and discover upon

what he bases his actions or directions. Few peasants will be able to help him much by explanation. They act on instinct or experience ; the reasons they may be induced to give are less likely to be correct than the conclusions which an intelligent amateur can draw for himself. They are also easily daunted. For this reason the amateur, even if he thinks he knows better on occasion, should hold his tongue. His object is to learn all he can, not to choke the possibly adulterated springs of wisdom. He will soon acquire a mass of small precedents, and out of them he will evolve a number of general principles such as will enable him to take an increasing share in the management of his climbs. A very small amount of principle, acquired and intelligently applied, will prove often of even more service than the local guide's instinct, which, unless he be a really first-class man, is apt to prove faulty under novel conditions of weather or of the unforeseen.

During his novitiate he should keep off the big exacting ascents, where he will have little leisure to observe, and where the amount he can learn of the reasons for following accepted lines, for avoiding others and so on, is small compared to the mere physical exertion that is called for. He should confine himself to the less known regions where some route finding is necessary, and to the glaciers and near rock ridges, where points of technique can be studied in repetition and variety, and beginnings and endings and alternatives of route and all the other matters common to small and big peaks alike—and vital to his education—are to be found in far greater numbers in proportion to the ground that an active man can cover in the day. One helpful variety he should allow himself during his study under a single guide in a home region. He should take an occasional tour of two days or so to climb a big peak in a different valley. This is a rapid way to acquire experience of all that guides can teach. It will be advisable to take on a second and really good guide from the new district to help the permanent trainer, who will generally have been, if he works in a less important centre, a man of second-rate technical, and of intensive rather than wide, guiding experience. The contrast in their styles will be worth watching ; and the expense is in any case less than that of engaging two regular

guides for a longer period—an alternative which, if he climbs in his first season from a popular centre, he will be unable to avoid. In his second season he may, if he wish, attempt some guideless expeditions, in a suitable region, with friends of equal or greater competence. But he should not allow this or any subsequent season in his early experience to pass without spending at least some period under a good guide or a first-rate amateur. He has so much to learn that he should not try to rediscover it all for himself. A genius who devotes years to rediscovering the first propositions of Euclid merely wastes time.

The Moderate Mountaineer.

The last case is that of mountaineers of some standing, who either on account of marriage, or of years and a comfortable habit, or from the philosophical attitude of mind which succeeds the enthusiasm of youth and smiles at its ambitions while it still enjoys a measured indulgence in its pleasures, prefer to be relieved of any kind of responsibility. These men take guides as a matter of course, and leave to them from choice the management even in those departments which their own experience would entitle them to direct. Their interest in mountaineering is a personal one, as an occasion for healthful exercise, for air and refreshing views. They pursue it for its distraction from other more worldly interests, not simply for its own sake. They are not concerned with its higher developments as a fine art, and as much from a modest appreciation of their own powers as from a deliberate depreciation of its possibilities, they renounce on their own behalf all the further opportunities which it offers for self-discovery and self-training, in the management of men and the progressive mastery of physical difficulty. The attitude has our sympathy. Those whose graver appreciation of the mountains, whose less tutored spirit of romance and adventure impel them to accept labour, responsibility, hardship, danger and sorrow as integral parts of their mountain service, and as a high discipline for body and spirit such as no other outlet from the enervating oppression of civilized life now affords, will recognize in this gentler manifestation of their own impulse a grateful proof of the fascination which mountaineering can still exercise upon every variety of civilized brain and character, upon men of finer intellect, wider oppor-

tunities for usefulness, and perhaps more balanced temperament than their own.

This considerable and often distinguished body needs no advice with regard to the conduct of its guided climbing; but it may not be superfluous to remind it of an obligation which it owes to mountaineering as an institution. If only because of their number and their more frequent meetings in centres—for the minority of wholehearted devotees are generally isolated, and guideless parties are independent and migratory by choice—these somewhat temperate mountaineers form the central body of alpine opinion. Whatever their desire to make their climbing merely a personal pleasure trip and to avoid the more strenuous currents, yet in so far as they use many guides and make with them the large majority of the guided ascents made in any year, they must be held responsible for the training of the guides, mentally and morally, while in their pay. They are assisting to create a considerable amount of abstract alpine doctrine both for the present and the future, and are establishing many more particular conventions affecting the attitude of guides towards amateurs, and of amateurs towards guides, and of the public towards both. But the attitude of mind in which they prefer to approach the pursuit makes them too often neglectful of the charge and of the lasting effect of their participation. Some from mere passive acceptance of the treatment as part of the game, others with an amused inward detachment, encourage young guides and old guides alike to manage every moment and movement of their day; satisfied that they themselves are getting all the profit in health and safety which is their limited holiday object. They are like genial uncles who join in a game and submit with an interior smile to the hectoring of their nephews, retiring when they please to make criticisms for their own and their neighbours' amusement in the pavilion. But in mountaineering the rigour of the game is essential to its good conduct. A guide indulged is a guide spoiled. An amateur indolently criticized may mean a position permanently falsified. Our small public opinion is not easily corrected. From the start, a right reputation is as essential for our social influence with the guides as it is vital for our mutual climbing safety. In the Alps we have a

large number of professionals whose living depends upon their maintaining a satisfying relationship with their employers, and a small number of amateurs whose pleasure in their holiday depends upon maintaining a suitable influence with their guides. The balance is difficult to preserve, and there is no room for dilettantism. Irresponsible handling of guides may in any decade result in a mass of amateurs speeding, by preference, guideless and insecurely uphill in a mountain sense, and in a mass of vocationless guides speeding surely downhill in a financial sense.

Summary.

A first-rate amateur, therefore, will take guides without hesitation, whenever he considers the powers of his friends too weak in general for absolute safety on the technical side, or the particular climbs they desire on occasion to attempt too exacting for their normal collective efficiency. His own concern with guides is to learn how to manage them and to get the best use out of their special qualifications.

Responsible, but less expert mountaineers, who wish to be independent, will nevertheless take first-rate guides for the same reason on occasions when their experience advises them of the advantage of their particular services to the party. They have to learn how to reconcile the retention of their own proper share of management with the greater share of responsibility in all departments which in this case falls to the first-rate guide.

Mountaineers who wish to be free of all responsibility will take guides because they choose to. They have to learn how not to spoil them, and how to prevent the example of their own voluntary surrender of their heritage from biasing their own and the public view of such of their contemporaries as may attempt to enjoy a different form of independence.

Novices will take guides as soon as they have discovered that there is anything they themselves do not know. They have to learn from guides all they can, so as to earn the right to do without them later if they desire.

Tourists, or experimentalists, intent to 'do a mountain,' will take guides.

It will be seen that the question of taking guides is no longer to be decided on the traditional single issue,

whether the guide is 'better' than the amateur. The question has now two aspects, even as 'leadership' has now developed two main divisions.

In the earliest stages of amateur accomplishment, while the beginner has no qualifications, the guide is taken because he is technically better qualified and has also, by local knowledge, instinct, etc., a larger proportion of the qualities necessary for management. The guide enjoys in this case his historic position of single responsibility.

In the second stage, where the climber may be only a novice in the alpine sense, the guide may possibly be technically inferior to his employer as a rock climber, a pace maker and so on; but in the absence of the amateur's alpine experience the guide deserves to retain his 'leadership' when his qualifications in both mountaineering fields are considered together.

As we move up the scale of experience, and the amateur is found to have developed more and more his initial advantages in the qualities necessary for management, the decision to employ or not to employ a guide depends more and more upon how far it may be thought advisable to supplement the technique of the party. Again, in proportion as the amateur and his party continue to remedy their technical inferiority, while they improve their experience in management, *pari passu* the need of a guide, in either department, diminishes. If he is employed, however, his general responsibility is proportionately decreased.

In these later stages the relation of guide and employer is one of expert with expert, and the guide's position, if he is employed at all, corresponds to that of a professional in a team, who is selected for some individual qualification which he is able to supply. It would be as ludicrous nowadays to rate the performances of such climbing combinations as praiseworthy or censurable, according as they were 'guided' or 'guideless,' in the old sense of the term, as it would be for us to assume that any cricket team which contained a professional must be *ipso facto* captained by him, or to refuse our recognition to any team which did not contain professionals among its members.

When, therefore, we are considering the case of a party of finished amateurs, men who are first rate in both

divisions of mountain craft, as climbers and as leaders in management, and who have no need of guides as a technical complement, we must be prepared to concede that for them there is now no rule. The matter becomes purely a question of personal preference and of personal discretion in the choice of the climb.

A Supreme Example.

I have left to the last the consideration of the one exceptional case where, for want of sufficient material as a basis for judgment, no clear crystal of modern mountaineering opinion has had opportunity to fashion itself, and where the old debate as between 'guided' and 'guideless' still survives with something of its old vivacity. This is the case of the highest flights possible in mountaineering, the ascent of the limited number of really great ridges and faces in the Alps and in less explored ranges. These climbs provide the most magnificent exercise of strength, endurance, nerve and spirit, all acting in harmony and all at their utmost tension, that human daring or ingenuity has yet discovered or invented. If they do not represent the limit of possible human achievement, they represent the limit of achievement possible with security in a single day of human effort. They are the ambition of every wholehearted mountaineer, but they fall to the lot of only the few. Many of them are seldom repeated; on others the conditions vary greatly between the rare ascents. Even among the fortunate few who succeed, it will be still fewer who can honestly say that they remained sufficiently masters of themselves and of the situation throughout the long day of extraordinary effort, sufficiently in command of muscle and nerve to meet all the physical demands unassisted and with a critical judgment, sufficiently conscious of all the tactical, human and technical manœuvres by which the success was finally won, to be able to recover from memory a detached opinion as to the relative difficulty of the climb, or to be able to estimate fairly their own ability to repeat the day 'unguided' in all its problems for leadership as well as in its tests of pure skill and endurance. It is a common failing among even the best of mountaineers to forget how much they have been 'morally' assisted by their company, or how little they may have personally contributed to the actual carrying through of a great

climb, in the afterglow of its success. The more we allow for the unusual physical and emotional reaction of these great ascents, the less security we feel in applying standards of common judgment to the opinions and narratives of their few conquerors. The body of ordinary expert mountaineering opinion is of little assistance. Mountaineers whose experience is limited to normal ascents, or who may even have 'done' some of these greater climbs between two expert professionals with their bodies and their judgments equally in a condition of suspense, are only a few degrees better qualified than the climbing public to judge of the combination of human faculties required for leadership and management in their secure conquest. We are forced, therefore, to take as our basis for comparison in forming our opinion the few records of such supreme ascents as have been performed by both guided and guideless parties. If, then, we examine these dispassionately, and allow for the golden spectacles of a natural exaltation, the greater where it is the less professional and the more personal, we may decide that the sum of purely dangerous incident, of benightments, races with darkness, breakages of cornice, etc., which they narrate, adds up to the disadvantage of the guideless ascents. The proportion of danger incurred is the one absolute standard by which all mountaineering can be judged. Between danger and difficulty there is a clear line of demarcation, which shifts according to our ability, but which is always perceptible. In doing without guides, these gallant parties, from their own accounts, while they triumphed equally over the difficulties, skirted more closely and more continuously along the border-line of danger.

Reason would bring us to the same conclusion. When we are estimating the limit of what is humanly safe in mountaineering, we are considering not what is securely possible for a single individual, a comparatively low standard, but that which it may be possible for an ideal combination of mountaineering qualities to achieve in one day. Up to the present time we find in certain of the best of the guides the highest development yet attained in one of the two groups of necessary qualifications; in certain of the best of the amateurs we find the highest development in the other. Until guides are

enabled to enjoy all the advantages of the amateur's education and mental training while they still retain their own natural conditions of life, or until amateurs can live the lives of guides and yet remain all that wider circumstance and opportunity assist to make them as amateurs, the finest mountaineering combination will and must still remain that of the associated group-qualities of guide and amateur, each group in its highest degree of individual development.

If a small but concrete proof were needed that neither the combination of the best of guides alone nor of the best of amateurs alone represents the most efficient type of mountaineering machine, it might be found in the history of the conquest of a number of great alpine climbs, which for years defeated alike good guides in association and good amateurs in association, but finally yielded in almost all cases to the combination of good guides and good amateurs.

But it is dangerous to dogmatize. When we are talking of exceptional ascents we are dealing with exceptional men; and if we say that for the safe performance of these exceptional ascents the best amateur parties will be strengthened by the addition of the best of guides, it is with the knowledge that amateur climbing has made extraordinary strides of recent years, and that in any season the conjunction of two or more hitherto unimagined amateur stars may yet further raise the recognized limits of the safely possible in guideless climbing. In such case, the time-honoured discussion as to what degree of difficulty makes a guide indispensable to an expert amateur party, in order to minimize its dangers, with all its heartburnings and rash intrusions, will be removed into an even more remote sphere than the already rarefied atmosphere of exceptional climbs in which alone it is still permissible. The matter may then be for super-mountaineers to debate. The discussion is now, in all but these extreme cases, dead. Sentiment or ignorance may still return to the old war-cries 'guided' and 'guideless,' used with the old significance, in fireside journals; in safe print moonshine may yet confuse the climbing ways which troops of stars have illuminated; but in the mountains new developments have established new doctrine, and a mountaineer is safe from criticism worthy of the name

if he regulates his practice according to modern interpretation.

The Management of Guides

If or when a leader decides to take guides, he has to know how to manage them. I have already said that he is not now entitled merely to engage the best guides available, and then leave all the direction and responsibility to them. Few modern guides expect or deserve this. His abdication will be followed by starts on wrong days, amazing meals, more visits to huts than mountains, unaccountable retreats, and final disgust with guides altogether. His party, at the close, will have attained no harmony and have lived divided into two camps. The amateur members will have been the least considered; they will either have been dry-nursed or oppressed. The surrender of their leader's functions to the guides will have left them with no authoritative channel through which to secure their proper share of responsibility and independence. They will have become discontented and adopted the conventional language of the lower criticism, abusing the guides for their tobacco, their peaty clothes, their drinking and want of enterprise; much as is still set forth in accredited climbing books of the 'picture-me-then!' class. The guides for their part, undirected and uninspired, will have fallen back upon their professional traditions and caution, meeting the unsympathetic atmosphere, which they do not understand, with taciturnity, aggravating interference or childish assertiveness. The whole blame will have lain with the leader. Just for a handful of silver he left them, renouncing his entire responsibilities because one or two of his party were to receive certain shillings in return for their skilled companionship. The party has had no leader, no focus for authority and opinion, and it could attain no success.

Guide Nature.

A guide is as much a human being as any amateur in the party. If it is necessary for the manager to have constant care of the health and *morale* of his friends, it is doubly so in the case of his guides. The *average* guide is a peasant, with the limitations that frame peasant virtues. His

guiding motive is the struggle for existence under hard conditions. His winters are spent in wood chopping, hard work and keeping warm, with cards, wine and village gossip for distraction. His public is preponderatingly masculine: in many mountain villages the proportion of boys to girls is five to three. His winter society consists of a fluctuating population, crudely packed for the cold months, and dispersed in parasitic occupations during the summer; it has therefore not even a parochial sense of responsibility in the creation of its prejudices. All talk circulates round 'francs.' His short summer season is a succession of conflicts with varying degrees of incompetence, in a business in which his conscious superiority is seldom challenged. It is impressed upon him that his most paying accomplishments are an obliging manner and a smattering of spoken tongues. He has small occasion to measure himself against other men or get an idea of his own personal value, because the world comes to him in its most artificial form, and plays him only at his own game with a fantastic handicap. He is a child, with a precocious development on a special line which gives him his one standard for manhood in general. Outside his valley he has to fear the antagonism, even the petty violence, of any local trade union; inside it he has all a schoolboy's fear of outraging some point of rigid local etiquette. There is no more of William Tell and the edelweiss post card in the material life of a Swiss valley than there is of Robin Hood and Merrie England in an agricultural village. If the guide turns back on an ascent, after hearing some incomprehensible patois from a fellow-villager the evening before in a hut, or if he refrains from bullying a surly official on our behalf, on whose good offices he may be dependent, or if he shows no active sympathy in our condemnation of a recalcitrant porter, who may be his wife's cousin, we have no right to expect anything different. If after a gorgeous sunset and a romantic ascent he still cares more for our francs than our fellowship, it is perfectly natural. We should look for nothing else, if we had not fashioned our typical guide in youth from the narrative of the great literary pioneers, who still found here and there a sympathetic village unspoiled by hotels and tourists, or a natural son of the hills whose responsive

courtesy could reflect, if it did not comprehend, the symbolical attributes, born of the realization of romantic success and physical well-being, with which the imagination of the contented employer invested his guide's leadership. We too find a few such men. But we recognize them as exceptions, or as beings who visit us in their full splendour only in the roseate hours of reminiscence following on a great climb.

The guide as we know him is hill-born, hill-bred, —that is, a child, with a child's capacity for becoming much what we make him,—a companion, a valet or a machine,—and with a child's suspicion and shyness, which he hides under an appearance of professional reserve or a formal politeness.

The Right Footing.

A leader must not be content with either the polite manner or the professional aloofness. He must first get to know his man thoroughly, watch his reactions on a climb, and notice his weak and strong points, where he is confident from knowledge and where he is merely bluffing. From his movements or silences he will soon be able to deduce more than from his speech. He should avoid direct opposition or discussion during the actual climbing. The guide is as sensitive and as inarticulate as any other uneducated handicraftsman on points that touch his professional skill or caste pride, and ill-timed interference will drive him to the polite manner for his protection. It is a mistake, also, to allow the relationship to become too personal, to expect a guide to act as valet or to perform small menial services in bivouac or hotel. There are many offices which a guide performs as part of his business,—cooking and carrying and the care of the party's comfort as a whole. But when an amateur has been indebted to his guide for putting on his putties in peace-time, it is impossible for him to resent being treated as equally dependent when the crises of battle take place. The relationship cannot be changed in a moment, much less in a crucial moment. The footing established in the valley, in the hut or on the long tramp, will remain the footing on the mountain side. Small hardships and small comforts have to be shared equally, that there may be an equal sharing of the big responsibilities of the campaign and in the decisions that go to meet difficulty or danger.

Start with your guide on a right footing, so that he sees that you recognize your duties towards him as much as his towards you. See that he gets decent food in the hotels; some head-waiters, portly with that authority which a tourist traffic inevitably confers, never learn to handle a guide as anything but a servant in your employment and something less in their own; but the guide is generally too loyal or too aloof in spirit to tell you so. Let him have what wine he desires: he will have to carry it himself. No good guide drinks to excess, some not at all. But fine-drawn men, not regularly nourished on meat, will frankly admit that failing such reserves the extra stimulus is occasionally really needed if some feat calling upon all their strength or endurance has to be carried through. A well-trained body, under primitive conditions, knows by instinct what particular nourishment it needs, and responds to its stimulus with startling suddenness. A good guide, on serious work, will never take more than nature tells him is required, whatever your opinion of that amount may be. Of course if he is a regular or irregular sipper in idle moments it is best to get rid of him. Be careful that he has not too much to carry; when there are several of a party, and each adds some trifle of personal luggage without knowing that the others may have done the same, the load often gets far beyond what the leader intended in selecting the provisions. His own food—he generally prefers his own of its kind—should be unrolled and seen to with the other packages. Sleepy hotel-porters, under the heading of "provisions for guide," are apt to stuff in mosaics of strange meats; and again the guide is too polite to tell you: it is not manners to worry the gentlemen. This is just the distinction which on all accounts you have got to break down. Consider his comfort as that of any other member of the party during the day, without seeming to fuss or to be condescending. It is hopeless to try and make him 'one of yourselves'; he has his own pride, and would shrug his shoulders over premature familiarity. But quiet consideration will gradually convert the relations into a pleasant mutual understanding. Take his sack as well as your own if he is leading and you judge the extra weight is taxing him unduly. Take your turn at leading in deep, soft snow. This is the only

task of sheer endurance in which I believe good amateurs can outlast good guides. Look after his getting his food and a proper place to sleep in, unobtrusively, when you get down from a big climb to new quarters, no matter how tired you are. It is in your own interest for the morrow. If possible, laugh him out of the common trick of dropping behind and making a sort of tail to your triumph as you return into the village or meet another party. He is taught that this is good manners and will please your touristship; but it is really insulting to both, if a man has been your companion or leader during a great climb of united effort, to accept this mock tribute to your poor dignity when there is no longer any chance of going a step wrong. The transparent imposition impresses nobody you meet, and least of all yourself or him. In the valley let the guide see that, as between yourselves, you consider that the fellowship remains unaltered, that you do not barter your right to be treated as his equal as a mountaineer for the sake of posturing as his 'Herr.' At the same time accept, for the sake of his comfort and his opinion of your tact, the outward appearance of differentiation which his training has taught him to consider consistent with his position and yours in this valley and hotel life. You will soon find out what you can or cannot do. You cannot traditionally invite him to dinner at the same table with other strangers in a large hotel, but he will join you for coffee at your separate table. Let him pay for you as you go. The confidence will make him feel of the party, and has the advantage of getting you large reductions through his local knowledge! Once he recognizes you as a human being and you have found the way through the crust of his professional suspicion and local upbringing, you will know him to be very human also, with a temperament as easy as a child's to understand and as difficult as a child's to manage; loyal, sympathetic, often sensitive, and naturally honest. He enters more into your aspirations than he ventures to show. Without sentiment, without sharing your thoughts or being able to exchange a word about all the varied interests that make up your own different outlook, without even understanding your motives, you may yet, if you are fortunate, find him a man who will become your close friend, with whom you can share

silence and danger and sorrow in a community of feeling that needs no speech. In contact with elemental realities, it is the essential personalities, not their different decorations of race or education, that count and that make contact.

Anyone who has followed me so far will probably be yawning, and asking, "Is this really all necessary in order to enjoy a mountain holiday?" It is not. If you want to follow a hunt, you have only to learn to stick on; if your object is to cross the Atlantic, you can do it in a liner; if you want just to do mountains, you can engage guides, behave like a gentleman, and you will have got your desire. But if you ever wish to realize the incomparably greater pleasures of hunting your own pack or sailing your own boat, you will have to set about it in a different fashion. Ask a platoon-leader or good company-officer what proportion of time he gave to the study and training of his men before an offensive. And then be assured that mountaineering is a pursuit in which, just as there is no limit to the ascending scale of pleasures which it offers, æsthetic and physical, so also there is no end to the progressive study and preparation it demands from those who would follow its higher walks.

The better a man knows his child-guide, the more he will know how to manage him, so as to get the best out of his mountaineering precocity. The happiest arrangement is no doubt to keep a careful eye open, during your preliminary years of training under the first professional, so as to mark down any enterprising young guides or porters. The young guide need not yet be an expert; it is for the amateur to give him the opportunity for developing his technical skill in their seasons of progressive climbing, while *pari passu* the amateur is establishing his own position in the partnership and perfecting himself in his own department.

The companionship of amateur and guide as friends is the ideal combination for great mountaineering wherever the ground permits of it. So soon as a second professional is added the amateur is in a minority; and no matter how close his personal association with his first guide, the professional comradeship, recalling the atmosphere of youth, may always override his influence for the day. A single amateur, therefore when he

finds it necessary to take on extra help for a season or for some expedition, will do well to choose some young man, the most athletic possible, who has his name to make and is still only thinly crusted with professional tradition. His inexperience may keep him at least silent in the discussion of important decisions.

Before the Ascent.

The principles of management are the same, whether the amateur is alone or with friends, and whether the guides are old friends or comparative strangers taken on for the season or even the day. Your concern is primarily with the guide's state of mind, so that he may make the best use of his skill. If your object is merely an ordinary ascent, it is still important that the leading guide should be kept in the right mood, both because of the greater contribution to the social pleasure of your party if things go rightly, and because, if checks of weather or of circumstance arise, as they always may, you have then neglected nothing that can contribute to a successful continuance of your climb. If your intention is something beyond the ordinary, your task of preparation is more difficult For the greater the technical difficulties of a climb, the larger must be the technical expert's (or guide's) share in deciding whether they can or cannot be overcome. The idea of the ascent has generally first to be made the guide's own by subtle suggestion at convenient moments. If you have got him up out of the valley in good health and spirits, you have still the danger of the hut to meet, where the patois of local guides, should your plan leak out, will affect his next day's humour fatally, even if it does not turn you back at once. In view of this danger it is sometimes best to treat your attempt as an 'exploration' only, until you are safely off on to the lower glaciers, otherwise you may find, when you wake in the hut, that the 'wrong rope' has been brought or 'the weather' is miraculously portentous. A mountaineer may hear these and similar whispered euphuisms, which are the preliminary to retreat, passing between a 'prompted' guide and his expostulating employer any night in any full hut. He will not feel it his business to intervene on behalf of another employer unless he is very sure of his ground. After all, the guide may have good reason to mistrust his employer's competence, and have chosen this polite way of saving his life or comfort in

anticipation. But the leader will be wise if he takes good note of the machinations, and of all their meanings, for his own protection in like case. Of course this kind of excuse may, in cases, be dictated by actual cowardice and not only by hut talk. My disregard of this possibility lost me one of the finest climbs I have planned. After all the gambits of hut excuses, 'weather' and 'rope,' had been countered, and we were actually on the mountain, my single guide, of fine reputation and great name, at the first sight of our formidable final ridge developed a 'sprained wrist.' It was a forlorn hope, which put an end to our association, and proved the downward turning-point in a promising career.

I must instance one other weakness that comes into special prominence in the bivouac or hut under the influence of other guides or of those fluctuations in mood to which the peasant is very subject in the prospect of some formidable climb. Very few guides know anything about 'weather' except a few local signs. But they will make use of their supposed instinctive knowledge to the utmost if they feel lazy in the morning or nervous of the undertaking. Possibly the 'head-shaking' is half genuine, as a guide has a child's fear of two things chiefly: a cloud and a falling stone. But the leader must not be imposed upon, and must use his own judgment about starting. I remember once in a bivouac, literally under a huge stone, beside the Mer de Glace, twice sending out quite a decent guide to see if his 'cloud-bank' was thinning. On the third occasion, when I asked if there were really no stars visible, he murmured drowsily, "Only two now," and snuggled down to sleep again. It is unnecessary to add that the guide and the party were wafted out of the gîte on the wind of the unspoken and ate their breakfast on the run.

I recall these instances only to emphasize the necessity of a close observation of character, so that flaws may be discovered in time, as well as the weak points shielded past the times of contact with external influences.

On the Mountain.

Once the climb is begun the task of shepherding is simpler; there are only the effects of untoward or premature mountain incident upon mood to guard against. But even so, occasionally, the effect of other parties on the same climb may have to be reckoned with. Their presence often

extends the debilitating effect of 'hut' promptings to the mountain side. If the feeblest of several parties on a mountain turns back, it requires a serious effort to prevent panic, and the fear of later valley criticism, from inducing a general retreat. To relieve your guide of this chance you may have to make it very audibly apparent to the other parties that it is you, and not he, who are insisting upon the advance.

Similarly, a guided party ahead of you, which may happen to take even an obviously wrong route, will exercise a paralysing attraction upon your leading guide's mind. It is overpowering if the two guides are acquainted. Once on a famous ridge of the greatest of Swiss peaks, when the guide of the party ahead of us chose the traditional but, on the day, the more dangerous of two lines, I had to say firmly that I should retreat rather than take the risk, before my own admirable guide could shake off the spell and consent to try the demonstrably better alternative route. Incidentally I may add that we had the satisfaction of sitting and watching from a secure ledge the sensational struggles of the other party for fully half an hour before they caught us up again. On the other hand, if the party ahead is led by a 'foreigner' or enemy guide, you may have to look out for the repellent effect upon your own guide, who will be only too ready to break off on any freakish alternative line which may give him the chance of cutting out his rival in front.

These cases illustrate a particular danger; but as a rule once the climbing commences the good guide is best left as much as possible to his free devices. Your authority must encourage the idea that in tactics the technical expert's responsibility becomes greater, and that in details the leading guide conducts the operations without question or dissent.

If he has been judiciously nursed on to his mountain, a good leading guide will be equal, unaided, to all ordinary situations and to exceptional ones according to his ability. But if your climb proves to belong throughout to the exceptional class, you must remain on the watch, ready to employ in time those fine shades of management to which alone nerves and muscles working near their limit respond. A good first man on the rope, guide

Fine Shades.

or amateur, is always an emotional subject, though his self-control may conceal his inward fluctuations. The leading guide's mood in the early morning hours of climbing will frequently be clouded by his sense of the serious work before him and the threat of responsibility it shadows for him. If difficult problems present themselves before he has warmed to his work, as they are apt to do on a severe climb, or before he has realized the support of the harmonious working of the party behind him, his mood will exaggerate their difficulty and the discouraging prospect of a long day of such problems. If you can then lift him over the crucial point without risk to your party, your pains and study will have been well justified. You must not give direct orders. A guide who will hurl himself against anything because he is told to, against his judgment, is a bad guide, or at least one whose temper and discretion are spoiled for the day. Nor must you abuse the power of indirect suggestion which your study of your man will have given you. A guide's instinct on technical points is an invaluable asset, and it may be harmed if it is tampered with tactlessly. You must first make up your own mind whether his objection to proceed is really based on genuine instinct or is only the outcome of a depressed and cumulative mood. And here your knowledge of the man and your observation of his condition before the crisis will help you even more than your examination of the obstacle which is checking him. Once you have decided that his objection is only due to mood, it is your business to bring him into the right key again; to make him feel that, while you realize the seriousness of the problem, yet your judgment, unbiased by the infection of gloom, is cheerfully confident that his skill can surmount it. Undue cheerfulness or obviously pretended confidence will defeat your object by merely making him think that you are out of touch with the situation or unaware of the gravity of the decision. Both words and tone, therefore, need very delicate choosing. The clouds must be given both time and a constant gentle impulse to clear off. Once the black hour is past, as it passes with most men as they warm to their work, the point comes, sooner or later, when every good guide catches fire. The amateur can then relax much of his attention even on a severe climb, enjoy the fun and

attend to the lighter problems of mere climbing. A day comes back to mind, the occasion of a first ascent of the snow slopes of a famous peak, when weather and evening company had alike contributed to oppress the wayward spirits of a peasant guide. Every form of inducement, 'exploration,' 'a nearer view for the next day,' had had to be employed in turn in order to coax a gloomy morning progress up the glacier, over the bergschrund and up the initial ridges. And then suddenly, and fully a third of the way up the ascent, a Napoleonic attitude with outstretched arm appeared in silhouette against the snow wall above us. We heard a cheerful shout, "Who follows me to-day will reach the summit!" And we knew that all need for nursing on our part had ended for the day.

Remember that however well things are going, unforeseen circumstances may always upset humour, and that you must be always looking out for its effects. You have to bring your party up, for each round with the unforeseen, at the top of its climbing form. A guide in the lead must be relieved of all anxiety about the performance of the rest of the party; his judgment of the succeeding problems must be kept clear of bias from extraneous considerations. He must feel that the whole party is in tune behind him, and is confident in him, or he will not be free to put out his best powers.

Mood or circumstance may, however, on occasion prove too much for your management, and then you need not hesitate to take over the lead yourself for a while. It is well for this, and for many other reasons, to have accustomed your guides to the idea of your leading. When this extreme course is taken, it should be done quietly and, if possible, under pretext of trying some alternative line of your own. So soon as the guide's humour readjusts itself, as it will all the quicker for watching your mistakes, the lead can be as quietly surrendered again. I remember a new ascent we made upon a formidable rock peak. Our excellent guides, overawed by the terrific threat of the sections far above us, tried prematurely to prove the whole climb impossible, by taking a fancy line early in the day which obviously led to a hopeless impasse. As it is the huntsman's privilege and duty, when scent is overrun, to make the cast and lift the pack on to the right line again, we exercised

it from the tail-end of the rope. Our ultimate success helped us to a mutual forgetfulness of the incident.

If you are climbing alone with a guide, of course either goes first as may be convenient at the moment. This should be taken for granted. Whether your party contains guides or not, you should always insist on taking your share of leading and encourage other amateurs to take theirs. It is good for your climbing to do so, it is far the best fun, and it promotes a proper footing with the guides. A guide has no prescriptive right to the pleasantest place. Only where the climbing is difficult, or danger is involved, the best man must lead; and this may mean more usually the guide. It is a mistake for an amateur, however brilliant, to let himself appear to be competing with a guide on his own ground. The guide will always be politely admiring of brilliance, but he is really only concerned to know that an amateur climbs safely, and equally safely all the day. The common good is better served by your appearing to take his superiority in the technical field for granted, and confining your attention to deserving the command you intend to exercise in the field of general responsibility. It is a sign that you are beginning to take your proper position, in your own sphere, when your guides cease to assure you that you are climbing like a 'chamois' or a 'devil.' But a young mountaineer is apt to feel injured that guides take so much longer in learning to pay him the first *real* compliment, the admission by their acts and not their speech that he has learned to go 'safely.' I remember in early days bitterly resenting being coddled on a short rope down an ice slope by two guides with whom I had just been sharing a sensational day, during at least four hours of which, if I had slipped, no effort of theirs could have saved the party. A guide, until he is trained by a good manager, never unlearns the most deep-rooted tradition of his caste. For him all amateurs alike remain *the* amateur, that is, a thing to be watched over, so long as the mountain remains a mountain, that is, a thing up which the guide leads. For years after he has forgotten to bother about his amateur on difficult places, where he has other things to think about, a return to familiar ground will recall to him the familiar tradition, and he will begin again to coddle his employer exasperat-

The Terms of the Association.

ingly. And for seasons after he has unlearned this habit, a guide will continue to prefer the 'backing up,' in a bad place, of a second-rate professional to that of the best amateurs in the Alps. Perhaps this is natural; the two natives can calculate on each other's actions and reactions more closely. Their co-operation must always be more instinctive and consequently more reassuring to one another.

An amateur must be content first to study the trade-winds of mountaineering, and then gradually try his wings on the more complicated cross-currents of its direction. Once he is qualified for his duties as manager, his old guides by habit, and any new guides by instinct or discovery, will soon concede him his full authority. With this as his fulcrum he will find it, in due time, easy to secure that both he and other amateurs of his party shall be left free to do their own share of the climbing on their own climbing merits, and only receive assistance (or what is intended for it) when they ask for it. When these terms are established it is happier for the party, and far happier as a permanent teaching for the guides. I was puzzled once to read in a hut book a notice that for the third year in succession the same gentleman had been forced to turn back by 'wind' at the same point of an easy ascent, although the book showed that on the same day other climbs on the mountain had gone well. Then we remarked that he had employed the same two guides on each occasion. They were earning their money, apparently, without undue exertion or interference in a permanent engagement. Possibly they may even have discovered that there is a humorous value in repetition! A few years later I heard of them as men of 'unmanageable stiff-neckedness,' and out of employment. But climbers will know of countless instances; and we must all have seen the village street tragedies of once famous guides drifting downward to chance engagements, trading on their names, irascible with their few patrons, still efficient, but spoiled, arrogant and accomplishing nothing.

The Rare Crisis.

No matter how well the guide's temperament is analysed and his moods managed, every guide's nervous system has a snapping-point, when self-control may be momentarily lost. As I have said when speaking of amateurs, to some it comes

sooner, to others later; but to the best guides, as to men of little or less education, it will come sooner than to the best amateurs. The crisis is a disagreeable one, and very rare. A thunderstorm, with its dangers that cannot be met by any skill, may produce it; a sudden fall of rocks or ice where they had no right to fall; or the shock of a realization of imminent peril. It will be always the unexpected. The amateur is then happy who has never weakened his influence by making mistakes outside his province or by exhibitions of his own temper or lack of self-control. If he has never given himself away under pressure of shock or disappointment or fatigue, then the greater the crisis the more effective will be his personal intervention. A few sharp words, startling but not angry, will prove with all good guides sufficient restorative. I have had occasion even to pay off an hysterical shouting guide on a mountain side before his frenzy,—the result of an uncontrolled temper and sudden panic,—yielding then to the fear of a solitary descent, died down sufficiently to make it safe to take him on the rope again. He was a bad guide, and dismissed on that account. But for the case of a good guide who has been tried too highly, the momentary correction will suffice, and the incident should not afterwards be recalled. I know of no other occasion which should justifiably tempt us into sharp speech or the exhibition of direct authority during an actual climb. The secret of maintaining control is never to appear to claim it.

The Reward.

In effect, an amateur is free now to take or not to take guides in accordance with circumstances and not with tradition. If he engages them, except as a beginner, it must be on the terms of mountaineer with mountaineer and not tourist with professional. He should get to know them as human beings, make friends of them if he keeps them, and treat them with the same tact as his other friends. In addition he has to give them the increased study and supervision which primitive temperaments, unknown antecedents, probable prejudices and possible personal value to his party deserve. His reward will be to find that his guided party remains free from many of the anxieties and disappointments with which other guided and guideless parties have to put up. He will find

that the modern guide, if he has little of the demigod of last-century tradition, has the potentialities of any wholesome, hill-bred human being. He will also, if he has deserved it, discover that the better a man, guide or amateur, becomes as a mountaineer, the closer he grows as a companion ; until a point is reached, in the fellowship of great ascents, when the distinction altogether disappears.

CHAPTER IV

ROCK CLIMBING

ROCKS are the framework of mountains. Rock climbing is a joyous method of getting up attractive mountains by attractive ways. But it is possible to be a rock climber without becoming a mountaineer. It is possible to earn a reputation by leading climbs upon some special type of rock without becoming even a good rock climber. The good rock climber is the man who moves equably, speedily and safely up or down sound and unsound rock, of every description and of any degree of difficulty that is within his physical powers.

A man who knows rocks and their structure and can climb them with understanding is potentially a good mountaineer. He has opportunities now of perfecting his craft which did not exist for his predecessors. Each succeeding climbing generation can enter without effort or loss of time upon an inheritance of skill and knowledge that its predecessors won with tentative effort and slow discovery. During the last twenty-five years the standard of difficulty that can be accomplished with ease and safety by a rock climber of ability has gone up some 25 per cent. To this rapid advance the literature published on the subject has contributed. The majority of climbs have now been charted and described; their difficulties can be allowed for. The mystery and uncertainty of new discovery affecting the mind, and the novelty of new adjustments imposed upon the body are alike eliminated as complications from the fair field of achievement. The climber goes out to meet purely objective difficulties, with his mind informed and expectant and his body trained and anticipating. The novice, or the expert in a district new to him, guided by his reading, can economize his nerve and muscle

for the more difficult passages, and, finding them the easier for this restraint, can pass on to always more exacting attempts with pleasurable assurance.

The presence in the hills of an increasing number of men who climb well and confidently has had even more effect than the publication of books and periodicals. Directed by advice, and by what is still more effective, by imitation, the beginner is no longer in danger of getting into habits of false positions and of false judgment, whether of the angles or of the character of rock holds. He grows up in an atmosphere where these matters are common knowledge, and he learns almost unconsciously.

A Theory of the Development.

Rock climbing in our modern sense is a young craft. The early mountaineers were drawn to the hills primarily by the attraction of exploration. Their principal interest was to find the best route to the summits. The snow slopes, to which the peasants and hunters who led the early ascents had been for generations accustomed, presented the natural means. Where snow failed and angles grew steeper they took to the ice walls and ice couloirs, since to their developing snow technique ice presented a more familiar alternative than rock. Steep, bare rocks were incidentally negotiated, but not from choice. The steeper, snowless rock peaks which offered no royal snow routes were thus naturally left to the last, and when the succeeding generation wished to find new outlet for the satisfaction of its own desire for discovery, it had to invent a new rock technique to solve the new problems.

The history has been the same in every form of sport or of adventure which has had the movements of the body and their perfecting in skill as basis. The passion for the sport that the many may possess engenders in the few who are better physically or nervously gifted a desire to heighten and prolong the sensation and to exercise their improving skill upon always more difficult variations. To the love of wandering in the mountains, shared by all mountaineers, is added the enduring pleasure to any healthy man of finding occasion for a higher self-realization, a more vital physical consciousness.

The evolution has been continuous; the generations,

of course, overlap, and the different phases of mountain enthusiasm can still find their several satisfaction. For the explorer there are still the untrodden ranges. For those with means and time sufficient to indulge their love of climbing among the great Alps, the old snow ways of the mountains still remain sufficient in number and in sensation. But for the ever-increasing number of men whom circumstances limited to the lesser hills of our own islands or to the lower alpine ranges, the grass and snow ways began to prove too unexciting as their novelty became exhausted, and the rock peaks and the sheer rock faces of the Lake Fells, Skye or the Dolomites offered a new temptation. Rock surface, unlike snow, proved to be almost infinite in its variety and inexhaustible in its offer of novel routes. Consequently the development of difficult rock climbing in snowless regions like our own proceeded at a pace somewhat out of proportion to the leisurely progress of the art among the British frequenters of the greater Alps. Even among the guides it was only the few, fired by emulation or educated by their employers, who maintained a rate of improvement at all commensurate with that which was taking place in the average standard of amateur home rock climbing. I am speaking here purely of *difficulty* and primarily of ascents. In the art of continuous climbing, and of climbing down, the comparison, as will appear later, was not equally to the home climber's advantage.

The principal agent in the change has been the study of the possibilities of balance in motion, and the training successively of the foot, the hand and the eye to secure a complete rhythmic movement of the body while climbing. The primitive belief, if we may make a deduction from the practice and recitals of early mountaineers, was that the body could not be balanced with safety unless the width of the foot had firm standing. Snow was found to satisfy this condition once the study of snow craft had taught guides and amateurs how to fashion a level tread, no matter what the angle of the snow slope. When the period of the great ice climbs followed, in the historical order of exploration, it became merely a question of discovering how to fashion a corresponding security of step in ice. When the new impulse developed for the undertaking of routes upon the rock

peaks, a similar breadth and comfort of tread were at first looked for. Consequently the rock ascents of former days were limited in number and character by this condition. Of the hands little account was taken. A walking balance was the only rhythm recognized. We might almost call this the 'walking epoch.' But the new generation, inheriting an always improving mountain craft, with a new goal in view, could not long remain at this point. The problem of finding sound routes up the rock angles of unexplored peaks and faces had to be faced.

The great gullies or rifts in the rock walls offered the first natural lines of temptation. The shelter of their enclosing walls promised a comfortable reassurance to nerve, and even more to the eye, as yet unaccustomed, as I have shown elsewhere, to the direct view into empty space, above, below and on either side, without its customary rest-point for the assurance of balance. So began what may be called the 'gully epoch,' a cul-de-sac which for a decade shut in, with a few exceptions, all the efforts of our rock climbers. Since the level tread could rarely be obtained in these gullies, body, shoulders and arms were all brought into the service, in order that the feet might still be able to jam against the requisite breadth of foothold, even though in such places tilted at an angle. At angles where these sloping footholds failed, the stemming of the shoulders and knees between the vertical rock walls on either side was discovered to be a means of bridging gaps on the climb that would before have passed for insurmountable. The substitute of this rough friction and purely muscular effort for the walking balance of the exploring age exercised for a time a restricting influence, although the freer use it made of the body in general prepared the way for a better tradition. Climbers got up steeper cliffs by their new methods at the sacrifice of their education as mountaineers. By specializing on a convenient accident of mountain architecture, one which cramped their outlook and left them little opportunity for achieving rhythm or perfecting balance, they even unlearned something of the general mountaineering knowledge which had been acquired by the wider, milder practice of their predecessors. It was this departure, with its somewhat clamorous record, that introduced the period of widest separation between

the old school of classical alpine mountaineers and the commencing school of island rock climbers, and which brought upon the latter the blast of, not unmerited, 'grease-polarized' criticism, that still whispers spasmodically and archaically. It deepened the rift that during this epoch the greater number of first ascents of the cliffs in England and Wales were made by means of those enticing gullies. For the classical mountaineers, trained in the Alps, when they took an occasional holiday in the Lakes or Skye, looked chiefly for the class of climbing which most closely recalled the varied types of ridges to whose structure they had been accustomed in Switzerland. Their successors, the Fell climbers, lacking their alpine training, yielded to the temptation of unexplored gullies, and for years enclosed our home climbing in these uncomfortable channels. Wales, with less potent climbers, followed the example. But Wales, with fewer gullies wherein to win fame, would appear to have been the quarter where the first bid was made for freedom. Almost simultaneously a similar change of view was taking place among the rock peaks of the Eastern Alps. Gullies are the natural lines for the descent of stones, water and snow rather than for the ascent of human beings. Of their nature 'faults' in the sound structure of the cliffs, intrusions of softer rock whose weakness water has discovered, their surviving walls present an undue proportion of unsound rock. These objections, combined with the gradual exhaustion of their temptation as new ascents, eventually forced our climbers to escape from their sunless recesses and to adjust their methods to less restricting requirements.

The first impulse came from a few individuals whose exceptional physical advantages led to their discovery that they could trust to their fingers as securely as to the full tread of their feet or the jam of their bodies. The discovery enabled them to attempt places where there were no containing walls to be relied upon as support for the body if the feet failed—problems such as wide-angled corners and even what would now be called slab climbs. Finger and hand holds in their turn became everything; footwork was neglected. To some exponents the feet were useful only as auxiliaries, scraped downward indiscriminately upon the rocks to give some extra propulsion. It was the epoch of 'grip'-climbing. Its

merit, apart from fine individual achievements, was that, in its turn, it set the succeeding generation free to trust itself more confidently on to the open ribs and exposed rock faces. Bare slabs which had hardly been looked at were then found to be covered with firm holds, upon which the toe or the side of the boot could stand as firmly and advance far more rapidly; while hands and eyes were free to assist them to an extent unknown before. The balance of the body in continuous motion above the feet was, as it were, rediscovered, and an upright position became again possible. The hands returned to their proper function of aids to the balance, and the feet, climbing in natural positions, became again of principal importance. With the discovery that the underlying principle of all climbing movement is rhythm, —a rhythm of the whole body and not only of the legs, as in walking,—and that the basis of such rhythm is balance, and not grip or stride or struggle, rock craft moved into its proper place in the forefront of mountaineering qualifications.

Such in rough outline is the history of the last eighty years of climbing technique. We must allow for much overlapping of the epochs in so short a period, and for many notable individual exceptions; but in the main this summary represents where we were and where we are, and what happened on the way.

In classifying the stages of our climbing progress into epochs or compartments, I am doing no injustice to the achievements of the past. A chronicler must always face the dilemma whether to say that the great man by his example produces the general change of practice in the next generation, or whether to class him as the conspicuous anticipatory ripple of a general current of coming change. Very young climbers may be often only human in their criticisms of their contemporaries and in their faint patronage of the collective past; for no really enthusiastic mountain-lover ever in his heart believes that anyone else has ever owned the hills and discovered climbing quite in the sense that he has. But every climber who is on the way to becoming a permanent mountaineer is a keen student of mountain history, and the services rendered to the world's mountaineering by the conservation of a body of central alpine tradition are never likely to be underrated. A good

house rises higher than its foundations, but it rests upon them. The men who first ventured on the discouraging angles of buttress and gully and cleared the grass and earth from small holds performed greater feats technical and moral than the most outside variations which may remain to be done on the same rocks by their present-day successors. They had everything against them, even the atmosphere of their generation. They not only led the way to the steep rocks; they started the assault upon degrees and varieties of difficulty that forced upon their successors the cultivation of the superior technique which they now enjoy. The mountaineering world has a tenacious memory; we cherish the names and exploits of the heroic age; the feet of our gods were solidly shod, and we will admit no clay to be visible about them but that which was honourably collected in their stout tramping.

Balance Climbing.

The change in style from epoch to epoch was a considerable one, and it has not been brought to perfection in several climbing generations. To acquire a balance rhythm in motion the whole body has to learn a habit of continuous simultaneous adjustments. Both feet and hands must develop a very fine sensitiveness of touch, so as to inform us not only of the exact amount of security each is contributing at the moment, but also—a different matter—of the value of their leverage for initiating a fresh movement upwards. According to these messages the balance is continuously adjusted, so as to relieve or compensate any extremity that may require it. The feet need only a sufficiency of hold to carry the weight of the body at whatever angle it is being held in balance by the hands. The hands need only that amount of hold which will enable them to keep the body balanced while the weight is being thrust upward by the feet. The feet learn to move inevitably on to holds no longer seen, but previously selected by the eye. Simultaneously, the eyes are already occupied in choosing the next holds for hand and feet, guided in their choice not only by the compensating quality of the hold which the balance at the instant may demand for one or other of the four extremities, but also by the direction in which the next movement can most securely be made. A system of continuous compensations, partly drawn from

the rhythmic balance of the moving body, partly from a corrective choice of succeeding holds, means a great saving of effort for the feet and hands.

The walking rhythm, of the first period, called for large, flat holds, and therefore for long strides between them. Between each hold the centre of gravity was thus forced out insecurely. The hands, when used, had the extra labour of dragging the weight inward against the outward thrust of the legs. The effort and the insecurity set a low limit to the angle of rock which could be conveniently ascended. The grip habit, of the middle period, demanded for its assurance sharp-edged cling holds, such as would enable the whole lifting movement to be executed by the hands alone. The body in suspension was thus wrenched inwards continuously, and sight and balance were interrupted. Rhythm on either method became impossible. On the other hand, a foot climber who climbs by balance or compensation appears to creep easily and continuously up the most severe slabs on an even line. His moving foot rarely lifts above the knee of his stationary leg, for he has his balance first to consider, and as he only needs small footholds at any angle to sustain it, he can find them at shorter intervals in greater abundance. His hands feel the almost imperceptible rugosities of surface with sensitive fingers, that press as often as they cling. His body moves upward, swinging out or in on a curve of balance with astonishing freedom, as the messages from hand, eye and feet are collated and complied with.

A man in sound condition, with his nerves and muscles trained, can acquire this mastery of balance in motion far more easily than would appear when it is thus set out. His body, at rest, instinctively assumes the right balance for a given position. He has only to train his eye to select holds ahead which will allow of a sequence of harmonic positions; to train his instinct to imagine beforehand what these positions will be; and to train his body to move from each one of these positions to the next, in balance and with an ordered and unbroken rhythm.

In this ladder of modern technique the first rungs of easier progress have been the relief to the hands and feet. A further step has been the relief to the knee, and incidentally to the clothes that cover it. It is now

rare to see a good climber return even from a week of conflict with that most destructive of all rock, the Chamonix granite, in the tatters of tradition. In Wales, succeeding Mrs. Owens need no longer " mend them with stuff of various colours " : the dark returns for decency's sake to Zermatt or Wasdale are adventures of the past. Even the style of clothes has something altered with the style of climbing. Practised climbers wear in all lighter materials, chosen for wind and water purposes more than for an armadillo-like power of resisting friction. The change in the knee is most significant. The armour plating of thicknesses has tended to disappear. The knee is usually innocent of patches and often left, in Tyrolese fashion, uncovered. The change is due to our change in style. While the foot still demanded broad holds, necessarily found at longer intervals, for its balance, the knee was constantly in requisition for an intermediate push up. While grip climbing obtained, the knee was more useful than the foot to jam with or to scrape downward against the rocks. It was also recommended for use in mountaineering manuals as a relief to those long strides and arm-pulls ! Now the foot works for both. The knee is kept in reserve for cracks and rococo mantelpieces, in interrupted climbing, or for a friction hold on spaces of smooth slab to raise the body the few inches necessary to reach new handhold. Since the knee is useless even on such occasions unless it adheres firmly, the breeches should not get dragged or torn. In continuous climbing it only serves us for light balancing touches, when the hands are needed elsewhere.

Yet another step has been the setting free of the eyes to perform their proper functions of balancing and of selecting. This release has been the main factor in confirming the rapid improvement in modern technique. During the walking era, and still more during the gully and grip eras, the climber had generally to take what his hands, unaided by his eyes, found for him. A climber by balance or compensation keeps his head well away from the rock, at the maximum distance permitted by the necessity of keeping his body in balance above his moving feet. His eye is almost uninterruptedly free to trace out his general line above, to choose immediate holds and to exercise, even as he moves, a comfortable

and leisurely discretion. He can see what he is doing all the time. To take one instance. On very steep rock that which has passed below the level of the knee is often already out of sight. A man who climbs convulsively, with his nose against the rock, has often missed the sight of some minute ledge to right or left of his line which alone offers a foothold from which his hands can reach above the next bare slab. Even if he afterwards finds it by the grope of his foot, it is too late for his eyes to estimate its security or shape. Similarly, he is unable to keep continuous watch ahead, and may often lose sight of a line of holds already marked from below; or he may overlook altogether some other easier line of holds which could have been reached by a timely divergence to right or left. Thus his chances of accomplishing a difficult climb are incalculably diminished.

And yet another step has been the economy in nervous and physical output. Rock climbs can now be repeated by the average modern climber with only about half the effort they cost their first conquerors, who did them by force of heart and muscle. They can keep, consequently, more strength in reserve. The interrupted continuity of our earlier struggle step and grip hold involved a disturbance of the balance and a break in the continuity of mental concentration. The recovery from every such movement put an extra strain upon both muscle and nerve. In the re-start after each 'jam' position, with its absolute arrest of rhythm of all kinds, the disturbance was even greater. Severe climbing of the modern standard demands controlled, continuous movements, so that the body's adjustments may continue automatically, and that there may be no interruption in the co-operation of nerve and eye and brain.

The beginner must expect to find that balance climbing does not come to him as a first instinct. Swinging from the hands to every hold which may be visible, and struggling and jamming with the rest of the body anyhow, so as to secure safety and impetus, are the primitive movements proper to self-preservation and common to all muscular animals like men and monkeys. Much muscular instinct has to be unlearned to overcome this instinct, which is the reason that athletes who have

accustomed themselves to reliance upon particular groups of muscles are generally bad climbers. But there is no more cramping fault than to yield to the muscular temptation, and to cling or jam when it is not absolutely essential to safety.

The rule holds good for easy or hard rock, sound or unsound. The sense of balance in motion has to be acquired, or, at the beginning of each climbing holiday, recovered. The lines of communication between toe and finger and eye, with the brain as clearing-station, have to be opened up or reopened. The ability to compensate, by the balance of the body, between hand and foot hold, and to relate the process to the task of selecting holds in anticipation with the eyes, has to be acquired or regained. Movement has to become rhythmic, and not convulsive.

The sense of comfort or ease in performing individual movements is the test of the degree of balance and rhythm acquired. The consciousness of comfort in continuous climbing movement is the assurance of a developed style. Easy rock ridges, of sufficient length, provide the best commencing practice. On them alone can practice rapid enough or continuous enough be obtained to convert what in the commencement must be separate efforts, each executed by a conscious effort of the will, into unconscious rhythmic movement as the habit of the body. The adjustment of the poise of the body and the judgment of the adjustment next required must become instinctive, otherwise an unexpected attitude forced upon us by the exigencies of the holds may upset the sense of comfort; and with the comfort goes the style; and with the style goes the security. The feeling of confidence is our test.

The Individual Standard.

If, and this happens to the most expert when out of training, a feeling of discomfort or mistrust intrudes, even for a flash, we are climbing beyond our standard. There is no error more fatal than the assumption that because we have once done a particular climb or perfected our skill to a particular rhythm, we can always and at once climb up to that standard again or recover our normal rhythm.

It must be repeated that the standard of difficult rock climbing has now been forced up to a point that practically represents the limit of human possibility.

If we may assume that there is a minimum of handhold or foothold to which fingers or toes however powerful or prehensile can cling, and that there is a maximum angle above which human strength cannot force its way up rocks by friction alone, that minimum and maximum have now been attained. Men of abnormal physique, confidence and endurance have of recent years perfected their individual rhythm of skill to the point of being able to ascend without discomfort or violent effort rock climbs that present the maximum angle with the minimum of holds. Beyond that point lies, not danger, which for ordinary climbers begins some degrees earlier, but impossibility.

It is folly for beginners or for ordinary climbers, as it would be folly for these men themselves when they were out of practice, to attempt such climbs out of mere courage or conscious fitness, or because they have heard that they are frequently done. What one man has done in climbing every man cannot do. In many cases the final conquest of these particular climbs has been due to some accident of abnormal reach or other development such as no skill could acquire, superimposed upon a perfection of normal style. If the climbs seem to be repeated frequently, it is because, though the parties may be numerous and various, the leaders of those parties remain few and the same—men drawn from the small group of the super-climbers.

Again, ability to climb rocks of the modern exacting standard is even as much a matter of mental fitness as of bodily fitness, of continuity in nervous control as of physique. An instant's failure of will or confidence, an instant's interruption in the nerve communications, due to fatigue or over-tension, will disturb the delicate adjustments of balance as fatally as a broken leg. Several of the most serious accidents of recent years have been undoubtedly due to momentary suspensions of consciousness, breaks in the nerve communications, produced by over-exertion of the nerves as much as of the muscles. Before nerve and sinew are alike fit and in training they can establish no rhythmic co-operation with one another or with the brain. And in this condition they are all alike liable to error in estimating the amount of effort or of compensation they can justly expect from each other.

The pleasant custom of association among climbers has its drawbacks in this respect. Climbers are gregarious, if exclusive. They tend to form eclectic associations in certain centres at certain times. They re-form into different parties under the same leaders. Consequently a number of men may begin and climb for years without arriving at an idea of what they are individually worth, or of what would be their normal standard if left to themselves. They may do a number of the severest ascents and discuss them with an equal confidence, and yet remain ignorant of what progress they have made in their own standard of performance or in nerve control. A climbing party pools its ability and its confidence. The longer and closer its association, the less are its individuals conscious of how much they contribute and how much they draw from the collective power. A weak climber may climb on some such rope with satisfaction to himself and no obvious personal inferiority, while he is drawing all the time on the common stock contributed by his more capable associates. A leader similarly, well backed up by a good party, may get into the way of deceiving himself badly as to the extent to which his secure performance really derives from them. Instances are not wanting of the trap this may become. A weak or moderate climber thinks he can lead a moderate party up a climb which he may have done comfortably several times with his usual strong party of friends. Alone, he gets into serious difficulties. A good leader, over-confident from the habit of always feeling a sound party behind him, may attempt a difficult or familiar climb with too large a proportion of novices on his rope. The amount of ability pooled by the party behind him will no longer provide a margin of safety against accidents. The slip of one will involve others, and his individual contribution of skill cannot be sufficient to check the disaster.

No man is fit to lead on easy rocks until he knows exactly his own unaided *normal* standard. No man is fit to lead on difficult rocks until he can gauge not only his normal standard, but also, accurately, his *standard of the day*. The second is as important as the first, but it is almost universally disregarded in practice.

To lead rock climbs of the modern high standard of difficulty demands a high degree of initiative, imagination

and nervous force, added to a suitable physique. First-rate leaders are, therefore, in a large majority men of highly strung nervous temperament; they are 'built on wires.' To have become great leaders they must have learned to dominate their wires completely. For such men, unusually aware of their normal standard, it is all the more difficult to consider or allow for accidental fluctuations in their physical or nervous condition of the day. But a particular climb may find even them either out of condition or suffering from an off-day. The off-day feeling, arising from countless causes, is one from which all mountaineers suffer; the more frequently, the more nervous their temperament, and therefore the more frequently in the case of this type of leader. If they disregard its presence or attempt to overtighten their wires to resist it, they run serious risks. The good climber must find compensation in the knowledge that the more he perfects his technique and rhythm of comfort, the less variation will he find in his normal standard; and the better he knows his normal standard, the less difficulty will he find in determining the fluctuations in his standard of the day.

The climber then must, from the first, learn to estimate his own performance irrespective of the contribution made to it by the rest of his party.

To secure this self-knowledge he need not climb alone. Solitary climbing has its own delights: of independence of movement and of remoteness from the whims of others; of a more intimate appreciation of beauties of sight and sound and incident, and of a sense of almost personal identification with the forces of nature, in their visible activity of movement and growth as in their passive compliance of line, colour and form with laws of slower change. The mystical moments in mountaineering, which are the source of its fascination for men of intellect and imagination, are found more easily in solitude. But these moments are to be experienced almost equally in solitary rambling or walking; and although their intensity is increased by the rhythm of climbing, the rhythm of mind and nerve and muscle working at the same high tension to the same deep tune, yet this superlative indulgence is only excusable for the supremely expert. To climb alone a man must know his own measure;

Solitary Climbing.

he must be confident that he can allow for his standard of the day; he must restrict his ambition to climbing of a class well below the utmost he could manage with a good rope behind him; he must allow something more for the nervous effect of solitude; and he must remember that all rock climbing is subject to a large number of pure accidents,—a strained sinew, a falling stone, or a breaking hold,—whose effects can be corrected or at least minimized by a united party, but any one of which may prove fatal to a solitary climber. If he is confident that he can make all these allowances, he may go alone on rock if he so desires. The question of what further limits he ought to observe out of regard for the apprehensions of others, his own circumstances or his relatively greater value in some other sphere, is a matter for private or domestic decision, and is not for the consideration of mountaineering opinion.

As concrete instances of the degree of difference that should be made, I take a few examples from rock climbs familiar to British climbers. A man who could lead the Grépon or the Dru (so far as their rocks are concerned) would be justified on his skill, if he kept all the conditions, in attempting all but the most severe Lake or Welsh climbs single-handed. A man whose limit in leading a rope was the rocks of the Géant or the Moine, or who found the Réquin fatiguing, could only safely undertake alone easy rock climbs, the orthodox ridges in Skye, the moderate Napes ridges, the buttresses of Tryfan and so on. Any man who found comfort in the presence of the rope, even behind him, on such ridges and buttresses as these last, should never attempt, when he is alone, more than the scrambling incidental to mountain walking. Finished experts must discover their own personal code of differentiation. They have only to keep in mind the distinction between difficulty and danger, as climbers know it, and to remember that to the solitary climber *every* difficulty may be dangerous in result. I say nothing here about solitary climbing on snow or ice.

Beginners do not come under any of the categories which permit of solitary effort.

The introduction to climbing customarily inflicted upon novices is practice upon single rocks, low cliffs, quarries and erratic boulders, with or without the aid of a rope held from above. This 'bouldering,' or prob-

lem climbing, may serve to discover a talent or encourage an inclination, but it is of little use as commencing practice. The scrambles are short. They give no opportunity for a ground-work in rhythm or for balance in motion. If they are easy, they are done at once on the head or the heels, and no one the better. If they are more difficult, muscle can either manage them,—a bad error to commence with,—or, if muscle fails, the ground close below or the rope close above deprives failure and success alike of any training for the nerve or moral for the memory. Their real value is only for the expert, who has learned to treat every rock with the same respect, be it of five feet or of five hundred feet. They make fine riders upon special propositions, of toe or finger joint, once we have mastered the general principles; but beginners get more benefit from easy, continuous exercises on the simple rules—and ridges.

Initial Practice.

This practice is best begun as a member of a roped party of about equal capacity, and under the direction of a leader who will only allow the rope to be used as a protection, and not as a method of traction. The climber is then to a large extent insured against the consequences of his early blunders, which will give him some necessary confidence; he will get some profit from watching other methods, and he can devote himself to working out his own style. Imitation, conscious or not, will give him right position, and the collective movement will infect him with the beginnings of rhythm.

In balance climbing, footwork must be placed first. For footwork on rock the right footgear with the right sole is all-important. If we wear a nailed boot, it should be as light as is consistent with strength and the weight of the climber—that is, of the lightest alpine pattern.[1] Large men often like the heavy iron-clad boot for the impetus it gives to a longer swing on levels or downhill. But this is no recommendation in ascending rocks, where the weight of the boot alone, since it has to be lifted and swung an indefinite number of thousand times a day, is a wasteful drain upon the leg muscles. At the same time the boot must be strong enough to

The Use of the Foot.

Hard Soles.

[1] See on Boots, "Equipment," p. 80.

protect the foot against bruise or jar on all kinds of rugged surface, and the soles thick enough to be firm, otherwise in climbing with the toe or the side of the boot there is unfair strain upon the finer fabric of the foot. The welt, for rock work more especially, should not project, as this increases the strain upon foot and leg in toe and side-foot climbing. A heavy welted boot or one with stiff leather uppers crushes the foot and interferes with its delicate sense of touch.

The method of nailing the boots is important.[1] Rock climbers pursue different fancies of their own: some prefer a double line of small nails close to the edge, for a better stance on small ledges; some dislike the edge or wing nails, and prefer a single row of small sharp heads; and so on; but the chief thing for rock is to make sure that the edge-nails, whatever they be, are set well apart, so as to give a rough catching edge between each nail against a pull either way. On the toe this separation is not so imperative, and they can be set closer together for mutual protection and for a division of the strain, which, in their case, will chiefly be on the back of the nail and not on its sides. To edge the boot with overlapping nails, which may become a smooth bar, is ineffective, and even more likely to produce a slip on rock than if the sole were left altogether unprotected. One good rough nail rightly driven in and rightly placed is quite enough to ensure a perfectly safe stance under a well-balanced body; and on much modern slab climbing one nail-hold is all that is sought or obtained. The neater the action the fewer the nails needed.

Soft Soles.

For a number of rock surfaces a soft sole serves better than a nailed boot. It permits of a sharper flex of the ankle, and restores to the foot much of the sensitive and prehensile quality of the hand. Its more flexible surface will cling to or over excrescences and flat planes upon which a boot could find little or no support. It enables the foot to be thrust toe-forward into narrower horizontal cracks or pockets, and toe-downward, for leverage, behind flakes split vertically. It is more secure upon steep, smooth slabs, in back-and-toe chimney climbing and upon delicate traverses. Its lightness and close fit give greater elasticity to the movements of the leg and greater exactitude to the placing of

[1] See on Nailing, "Equipment," p. 82.

the foot. On the other hand, it has not the grip in the smooth angle of a vertical crack or corner that a hard sole has ; in side-foot or toe climbing on narrow ledges of sheer rock it strains the foot unduly ; it is treacherous on greasy or glazed rock, and absolutely useless on snow, ice, sharp rubble or in greater mountaineering. From my own experience I should say that there are few steep places that the *ordinary* rock climber meets where a nailed boot cannot be used as securely as a soft sole, but that there are many where the soft sole is more comfortable and reassuring. We have, of recent years, imitated Dolomite climbers more generally in their use upon abrupt crags, and when we have finally got over our prejudice against carrying extra footgear with us and bothering to put it on, there will be as wide a popularity for the soft sole, discreetly used, upon rock as the claw has at last begun to enjoy upon ice.

According to the texture and condition of the rock, soft soles of raw hide, thin leather, woollen cloth, canvas, flat or ribbed rubber, rope, and even the soles of bare feet of a naturally leathery quality, are all and each declared to be the best possible wear. It is impossible to assign them geographically and geologically in detail, and I doubt if anyone will carry with him all the types on the chance of using one quite correctly. The average rock climber, even though he knows the truth that on some rock boots with hard nails, and on others boots with soft nails, give the better grip, shows himself still discouragingly reluctant to carry even these two pairs with him in our own islands. I myself preferred a light rubber sole on dry difficult rock, and a rope or cloth sole on wet rough rock (not greasy), whenever the difficulty made it distinctly safer than a nailed boot. Rubber is less durable than rope, but it remains more evenly prehensile. The rope sole, recently used with great effect even in the greater Alps, gets hard and, still worse, hardens in patches that give a fickle tread.

For prolonged wear a soft-soled canvas boot is more comfortable than the traditional shoe.

Many rock climbers wear very thick stockings or several pairs of socks.[1] Their protection to the foot is greater than that of weighty or rigid boot leather, and,

[1] See "Equipment," p. 83.

according as feet and boots vary in size from day to day, they allow of a corresponding addition or subtraction. But for pure rock work their thickness should never be allowed to interfere with the sense of touch in the toes. Any constriction round the ankle, by the boot, or round the knee, by the breeches, is for the same reason to be avoided. To check the circulation or to cramp a sinew or muscle is to interrupt the telegraphic messages upon which balance and safety depend.

Foothold.

The feet in all climbing should be placed lightly, and the swing of the leg kept under control. To aim the foot, as many do, from the thigh and knee, bang it in, and then leave it to settle itself on the hold, is to jar the foot and fatigue the leg. The movement should be precisely directed from start to finish, and no sinew slackened until the other foot has taken charge. In continuous climbing the position of the foot on the new foothold should be chosen with a view to its supporting the balance during the next movement up or down, and the foot must be placed exactly as the eye designed. If not, the balance will not rise true on the lift, and there will be a flurried hand cling and a clumsy foot shuffle until the right foot position is found. Small inexactitudes mean clumsiness and waste of power.

Good skating calls for the same precise adjustment of the feet in anticipation of the next movement of the body. But the closest parallel is to be found in good dancing. The motion of foot and leg in both dancing and continuous climbing is free yet under control, rhythmical and balanced to the appearance of ease, but precise; ready for the new position required for fresh movement, and yet keeping the body in balance during the momentary transference of weight. In both, the actual contact of the feet with the surface is always light. In either, a heavy or loose tread not only breaks the rhythm, so that the balance has to be recovered by an effort, but it destroys the sensitiveness of touch, and delays for a perceptible moment the beginning of the next movement. Dancing is, in fact, an excellent preparation for climbing. Good climbers are, or can be, nearly always good dancers. The account often given in joke of a fine climber that he 'literally danced down

the rocks' is a truthful picture. A good dancer has to adjust the continuous motion of his feet and body over an even surface to the swift and varied rhythm of music. A good climber has only to keep true to his own rhythm; but he has the more difficult task of adjusting his continuous movement to the varied angles, checks and impulses of uneven rock holds. The more difficult the rock, the slower must be his rhythm; but slow or fast, each motion must remain equally exact and finished. The more precise he renders each movement, the safer will be his progress and the more polished will appear to be his style. All false positions, sudden convulsions or recoveries that will break the continuity of movement, have therefore to be avoided. In ascending upon a vertical line it is, for instance, obviously better to take footholds slightly to the right and left with either foot rather than immediately below the body. The knee thus turned sideways can be flexed without thrusting out the centre of gravity and interrupting the continuity. Again, as between two footholds that may offer, the one large and reassuring in promise but inconveniently placed, the other less comforting but at a happier interval, the latter is to be selected. The first would be sound, but would need two interrupted movements and a readjustment between them; the second will fit in with our continuous movement and be secure enough to reach and to leave again. Rock holds are not required for a permanent residence. The foot, the toe and the side nail are not looking for snug berths with a pension, but only for such security of tenure as will permit them to promote the career easily from one balanced movement to the next.

Anticipation.

Upon very steep rock, holds rarely occur in the convenient, ladder-like sequence that allows of a continuous lifting of the body in the same position and line. Each succeeding set of hand and foot holds may here require a new attitude for purposes of balance. For this interrupted type of climbing, however, it is just as important to remember that it is too late to begin to twist the body into the new position required by the new holds when already those holds have been reached. A climber who makes this mistake gets no help even from his slower rhythm, and looks to be spasmodic and insecure. All the more here a good

climber should look beforehand what his new attitude will have to be on the new holds, and, like a skater, he should move his body into the new position while he is in the act of passing from the one set of holds to the other. In the case of an awkward step it is even admissible for him to go up and down to it, tentatively, before committing himself to it, in order to make certain that he will arrive upon the hold in the right position. He has then no need to readjust his feet or hands when the movement is complete and the next begins.

This fine point in style is invaluable to master; anticipation saves energy and assures safety on long or difficult rock climbs. The sinuous progress of the expert on an 'interrupted' passage is effortless as compared with the jerks and quick contortions of a less finished climber on the same place; and on long, easier climbs, where all are moving together, he is always the sooner ready to meet at any second the failure in his own case of a single hold, or to give the immediate check to the rope which shall correct a slip behind him. Even if he is in mid-movement when the call comes, in an instant of time his feet and hands can lock his balance into the new position already half attained, or they will bring him back with nicety to his last firm holds.

The Ankle.

In the mastery of balance climbing the ankle plays a very important part. So that the body may progress smoothly when the feet are clinging only to small or very inclined holds, the ankle must be strong enough and supple enough to support the weight at rest or in motion, no matter at what angle it may be bent, forward or backward or sideways. The extent to which the ankle can be flexed varies with the individual. Extreme in babyhood, the flexibility can be preserved by early and suitable exercise. Once it is lost, and the foot 'set,' it is very difficult to recover or increase it in later life. Those whose ankles will only flex city-wise may only envy the ease with which mountaineering peasants walk straight up steep inclines, getting their heels down each step, or coastal fisher-folk hurry safely on flat soles along slippery sea slabs at impossible angles. If your ankle won't bend so far, it won't. But what can be and has to be acquired is suppleness and strength in the ankle, whatever its flex, so that it will hold as securely when bent to the full as

when straight, and will relate through its changing but steelly arch the balance movement of the body above to the unshifting cling of the foot below. Like skating, ski-ing or crabbing on claws, walking securely with a flexed ankle has to be learnt by practice; and the first essential is confidence. Balance boldly on slabs. If you lean inwards, or seek support with the hand, you will never improve your ankle work. Such practice on ice with claws and practice on slabs with shoes or nails are mutually helpful. It is excellent exercise for the ankle and foot to practise doing ridge or slab climbs of progressive steepness without using the hands at all. The flex of the ankle, the bow of the leg and balancing power of the trunk muscles working together, can learn to do a great deal for which we are ordinarily too ready to use the hands. By educating ankle and foot to work alone we keep the hands in reserve for increasingly difficult passages. Often the 'prop' of a bent ankle above a side-foot hold gives us the second point of contact with the rock which is all that our balance requires. I have known of climbers whose standard improved markedly owing to a hand injury or arm wound. Compelled to develop their ankle and foot work, by the time the arm recovered they had learned a better 'balanced' style, and the fresh help of the hand came in as so much more gain in power. Careful hill walking or rock climbing in a light shoe is better training for the ankle and balance than walking in a heavy boot. The heavy boot restricts the flex and weakens the ankle by always supporting it. On all but rock surface it compels the surface to its service. On rock its rigidity and good side nails generally save us the trouble of flexing the ankle at all. In a light shoe the foot and ankle have to adjust themselves to the surface, and bend and adhere at any angle the hillside or the sloping rock may dictate. The ankle gets strengthened and suppled. Be it noted that the going must be 'careful'; an unprotected ankle until it gets trained is easily turned or wrenched.

The Knee.

As I have said, the knee is not now so often used in good balanced climbing. Nine times out of ten when we use a kneehold it is from pure laziness, and eight times out of ten we immediately repent it, because it is quite three times as difficult and six times as painful to start again off a

kneehold as off a foothold. Of course on stiff 'mantelpiece' work or in cracks we may have to use it, together with all other convenient projections of our frame. And, on occasion, in continuous climbing, if the hands are occupied with the management of the rope, and the foothold is too high to reach with sound balance, the knee can be used on a suitable hold as a quick half-way thrust between distant footholds. This avoids breaking our rhythm by an overlong reach up with the foot, or interrupting the party by dropping the rope in order to take hold with the hands.

Some men, and nearly all women, when they use the knee incline it inward across the front of the body, so as to place it on a hold with its point or outside surface in the direct line of ascent. This leads to a very constricted attitude. The lower foot cannot be brought up below in support to any hold on the direct line, and, after the lift, a pull on the rope or a violent effort will be necessary to recover the balance or get started off the knee again. The knee should be inclined outward away from the body, and should use a hold with its inside surface, to the right or left of the direct line of ascent. The spring off knee and shin from such a hold lifts the weight lightly in the direct line, with the body continuously close to the rock, and the lower foot can be brought up easily to a supporting hold in the direct line below the body, so as to relieve the knee. (Try the positions on the edge of a table or on a step-ladder, and the difference becomes clear.)

On very smooth slabs, when foothold fails, the knees and shins can be used to relieve by their friction a pull-up on the hands. If we are wearing shoes this is a rare case, as a soft sole can cling anywhere (and more safely) that a knee can. Such a friction-cling need necessarily be only for a short distance,—about the stretch of a man's reach,—since the boot, as soon as it has reached it, will be able to use anything that has before been sufficient for the fingers to hold on by. There is only the one exception—the problem of a vertical or sharply inclined slab, offering us only a smooth narrow crack or a smooth sloping outside edge. The crack or edge may be good enough for the fingers, but too smooth or steep for a sideways boot toehold. In this case the whole outside surface of thigh, knee and leg come into

play to give friction-holds on the slab, while the hands are shifted upwards in the crack or up along the edge. (The positions can be tried on a heavy door or gate, set on one corner and inclined steeply in the angle of a wall. For the one case the door must be sun-cracked!)

The Hand.

The hands and arms have to learn less than the legs. They are less important for anything but purely gymnastic climbing; they have more inherited instinct for their work; they are under the constant direction of the eye, and therefore do not need the same training in automatic movements to carry out anticipatory judgments.

The hands are always auxiliary to the feet and to the adjustment of the body. Their power only misleads into a bad style if they are used to the neglect of other parts of the machine. In continuous climbing they complement the lifting movement and assist the balance. Their service is for impulse, adhesion, occasionally for traction, but never, if avoidable, for suspension at rest. Footwork, not handwork, is the basis of balance climbing.

Cling Holds.

In steep climbing, where they come more into play, instinct directs them how to cling. But in taking finger-holds, especially for pulls, it must be remembered the hand is as fine a piece of machinery as the foot, and less protected. It can be easily cut or bruised, or the tips rendered callous so that they lose their sense of touch. A well-used hand after a few days on rough rock gets if anything more sensitive; the fingers become 'violin tipped' with a certain prickle of sensitiveness. A hold should be grasped like a nettle, firmly and almost finickingly, so that the skin does not shift afterwards or drag. It is always a bad sign if the climber finds cuts on the insides of his hands. They have no business there. The sharpest of holds, if rightly gripped, can be used for the lift of the weight without puncturing the skin. Abrasions on back or side of the hand, or on the inside of the wrist and forearm, are another matter. They almost inevitably follow upon the action of arm-levering and on the taking of press and push holds (afterwards described). Incidentally, also, frequent knee and shin scrapes and bruises are the signals of clumsy footwork and scrambling methods.

As a complement to the ordinary cling holds, when the fingers cling over an edge or knob and hold the weight in suspense, balance climbing based upon footwork enables us to make use of a whole group of invaluable 'under'-holds. In these the hand, gripping palm upwards under a down-turned edge or point, is getting security and propulsion by pulling the body inwards against the upward thrust of the balance from the feet. The value of these holds depends upon our practice in balance climbing, which enables us to 'compensate' as between our hand and foot hold and to maintain a careful counterpoise of the hand-pull against the foot-thrust. We can use them with effect anywhere between the level of our eyes and our waist, according to our strength, and our ability to use them adds immensely to our ease in climbing vertical or overhanging rock. A cling 'over'-hold on such rock pulls us inward, and adds blindness and body friction to the other forces working against us. A cling 'under'-hold keeps body and eyes free at the length of our arms, bent or straight according to our convenience. Granite is rich in such fashion of hold, and on rough, catchy aiguille climbs many of us would use them by preference before the more obvious over-holds.

Cognate with the under-holds are 'side'-holds, where the edge or point of rock projects and is grasped sideways. The principle of their use is the same as for the under-hold, except that the hand is turned sideways. Their commonest occasion is in the ascent of cracks, when the outward side-pull of the hand against the inside edge of the crack is set against the upward thrust from our foothold or knee-jam in the crack below, and our balance technique is occupied in compensating between them.

In cases both hands may be pulling against opposite sides of such a crack, and the compensation will then have to be made between the two arm-pulls instead of between the single arm-pull and the foot-thrust. To make any upward progress on such holds without any help from foothold or body friction calls for immense arm and finger power; but in connection with a foot-thrust or knee-jam the opposing side-pulls are often of use. A square-cut or rounded edge, without any projection, is sufficient to give good side-holding.

Instinct will tell us how to hang on to over-holds and pull up at the length of the arms. Practice in balance and footwork will teach us how to avail ourselves of the varieties of the more accommodating under and side cling holds. But the balance climber has to learn, for the yet greater convenience of his eye, the ease of his balance and the economy of his arm-power, to take his handholds as low as possible, and in co-operation with, not in opposition to, his foot-thrusts. He soon discovers that 'push' and 'press' holds are more powerful and accommodate themselves better to continuous upward progress in balance than any form of cling holds. I use 'push' of a direct upward thrust of the arm from a horizontal or inclined ledge or hold, and 'press' of a lateral or diagonal thrust against a vertical or inclined side-wall. (The first can be tried on any secure mantelpiece; the second, not so well, in any narrow passage.) The arm, for push holds, is used after the fashion of a leg; the hands are pushed, palm downward, on ledges at a height that will allow of the weight, with often the impulse of a spring or foot-thrust, being lifted on the straightening arms. The arms for this movement possess much of the strength and the ease in balancing usually attributed only to the legs. To lift the weight on a direct push is easier for many than to raise it by a long-arm pull. On push holds the weight of the body keeps the hands firmly in place; and a hold by thrusting friction, even if it be only on a rounded or sloping ledge, calls for less effort than to keep the same weight in suspension from the crook of a muscular finger round an ideal hold at the stretch of the arm. The strongest position for push holds is that with the fingers turned inward, the palms downwards, in front of the body, at a level anywhere between the waist and neck, according to the individual power of spring from the feet. But push holds outside the body are also useful; the fingers are then turned outwards, palms down. Either of these positions secures the help of the twisting arms as levers for retaining the balance during the upward movement.

Push and Press Holds.

Upon slabs or on rounded holds at awkward angles a very useful hand device is the combination of the push and cling holds. The wrist or forearm rests along or

over some protuberance so as to secure a downward push hold, while the fingers are turned to cling across some edge of this hold and keep the arm from slipping off it. The arm would slip off the push hold but for the anchor of the fingers ; the fingers would slip out of their awkward cling hold but for the friction anchor of the arm. Thus by a delicate compensation between the forearm pushing and the fingers clinging we obtain one sound combination hold out of two separately insecure holds. Ledges are more frequently rounded or inclined against us than square and convenient. The reinforcement of an arm push hold by a finger cling, or the giving of a right direction to a finger cling by the friction anchor of wrist or forearm, is therefore of constant service and deserving of all practice.

In press holds the flat of the hands is thrust sideways against a smooth surface of vertical or steep rock, which may be the retaining wall of a chimney, or a projecting leaf or corner. It is a help if the outer edge of the hand can rest against any seemingly valueless excrescence. With the hand so held the elbow has only to be lifted, and the arm becomes a lever, thrusting the balance inward, secured by, and itself securing, the friction of the hand. Two hands so pressed against any sloping surfaces can lift the whole weight. Pressed against vertical surfaces—the inside walls of cracks, for instance, too narrow to admit the body—they are sufficient to retain the balance, while the feet find any slight hold, or even only friction holds, to supply propulsion. How good the foothold must be to complement such handholds is a matter of practice in compensations.

Push and press holds with the hands, combined with the twist and leverage of the arms, in combinations innumerable, are the refinements of exceptionally difficult climbing. Their merit is the saving of muscular effort and the substitution for it of the mechanism of balance. Their use has inevitably grown out of the new fashion of footwork developed in balance climbing, grounded on the recognition that the more extended the body and the wider apart feet and hands are fixed, the less is the power and the greater is the effort of single movement, and therefore the greater the interruption to continuous rhythm. To keep the balance steady, the eyesight free and the rhythm constant, footholds and handholds must

be taken at convenient distances well within the compass of the reach.

In Cracks.

In difficult crack climbing the extent to which pressure, the jamming of a leg, the touch of a calf or knee, or the twisting of a hand or forearm can be used to ease the muscular strain must be learned by practice. A fist or finger may be hooked in a smooth rift, or a foot slanted into a crack, with only friction attachment, and a slight twist to arm or leg converts either into a secure lever for lifting the weight. The clenching of the fist or the tightening of the muscles of a jammed forearm, or even the inflation of the chest, may at need serve the same purpose. The inexpert eye might see little difference between such movements and those of gripping or clinging. As a matter of fact, the difference is maintained even here. Where a grip climber aims at rest-points of pendent security, and struggles between them by muscular pulls, the balance climber is primarily concerned to keep freedom and continuity of movement. He is using the balance of the body, if only for fractions of a second, to relieve the direct weight on his arms or the indirect strain on his legs. His arms and legs are levers in converting proportionately slight muscular efforts into big continuous movements, making friction and the mere weight of the balancing body do a large share of the work. Consequently, to the expert eye, his body is seen to ascend on a line slightly farther out from the rock than the grip climber in the same place, and in a different sequence of attitudes. He will be avoiding at all costs the grip climber's temptation to be too secure, to fix himself in attitudes or on holds from which he will have to emerge by direct muscular pulls. In corners or chimneys he will use a set of slighter and less attractive holds, if they exist, farther out, so as to keep his body free from friction against the rock. If such a set of holds is lacking altogether, he will be employing press holds with the hands, lever holds with arm or leg, twisted pressure-thrusts from his foot and ankle against one wall to his knee against the other—any device that will relieve him of direct pulls and will leave his body free to help him at any second with some balance adjustment. For, once the body is really jammed up against the rock or in a crack, arms and legs are usually working only against one another or

against the friction of shoulders or thighs, and the mechanism can merely struggle and exhaust itself.

On Slabs.

Similarly upon slabs he will be selecting holds, not according to their size and obviousness, but according as they are arranged well within his comfortable span. He avoids at all costs getting 'spread-eagled.' The surest safeguard against getting stuck is to select the holds beforehand, and then be certain that your feet and hands use them as you designed. Let nothing tempt you to alter your plan once you are moving. This is the hardest lesson to learn. If you have any eye at all, your alteration will never be for the better. Whenever, as must occur in awkward places, your sight of the holds is interrupted, keep your head and stick coolly to your recollection. Many climbers get slightly flurried once they are 'blind.' They forget their plan, even the existence perhaps of the one hold that made the passage seem possible in anticipation. They revert to struggling and arm-clinging. Their agitation often takes the form of a combative recklessness. They feel they will fight it out with the holds they have got rather than descend and recover the safer line they planned. This liability to flurry may take years to master. Most of us have suffered from it; and notably in those attractive holes under chockstones or overhangs—holes so irresistibly tempting to thrust one's head and shoulders into, but from which, blinded and out of balance, it is extremely trying to emerge. Notably, again, on those steep problem-slabs, where a single tempting hold has spread-eagled us helplessly and left us wondering how long the single nail will support us.

The only protection is foresight, a steady adherence to plan, and the resolution always to climb as far out as possible from the rock.

If the hands are allowed to pull the nose into the rock we are easily pounded. The protection is footwork and the flexible ankle. It is the business of the ankle to bend and stay bent at whatever angle may keep our body in safe balance and away from the rock, and to transmit our weight to the foot at just the right angle to hold it firm on its sloping stance. The farther out from the rock we can keep the weight, the steeper the apparent angle of foothold which it is safe to use. On

steep slabs a very flexible ankle will often let the foot rest flat, getting an overlapping or friction hold on several rugosities of surface with its whole sole where a less practised ankle or a stiff-sided boot must trust to the less secure catch of a side-nail on one such roughness. Quiet movement is essential; to leave a slight hold hurriedly is as dangerous as to arrive on it clumsily. If you have to use a knee or hip or forearm as a friction hold, set it as gently and relieve it as lightly as if it were a single finger.

Chimney Climbing.

Chimney climbing is another occasion for too alluring rest positions and for tempting but over-close contacts. By a 'chimney' we usually mean a rift that will admit the body, as contrasted with a 'crack' which will not. The method of ascending between the vertical or steeply sloping walls of chimneys, wherein holds for ordinary foot and hand work are lacking, is usually called 'back and knee'; more correctly it should be named 'back and foot,' as the knee need rarely be used. The position is with the back against one wall and the feet against the other, the legs bent or straight according to the width, and the thrust of the spine and shoulders providing the security. Here again the proper object is continuous movement, and such attitudes as may assist towards it. The temptation for the safety climber is to sit across the chimney, with the legs straight and almost at right angles to the body. The body is then wedged; it sinks slightly inside the clothes, which are fast to the rock by friction, and, while it is quite secure, presents also the utmost resistance to any upward impulse. The right position for the feet against the opposite wall is slightly below the body, as low as will allow of an easy upward impulse being given to the body without risk of the feet slipping. The hands and arms are stretched downward, past the body, with the arms bent and the palms flat against the rock behind. For movement upward, one foot is brought across from the opposite wall and thrust with the flat sole against the rock close under the body. The friction of the foot then allows the bent knee to be partially straightened, and the body raised. While it rises, and the shoulders thus come clear of the rock, the thrust of the arms and hands backward against the rock takes the place of the jam with the shoulders, and so keeps the

foot against the opposite wall in its place. So soon as the lift is completed and the back is at rest against the rock again, the under foot that has been used is shot across to a higher position against the opposite wall, the hands move up, and the other leg comes across, to act as spring in its turn. The body is thus really ascending, poised, between the shifting pressures of the arms and feet, and is only taking instants of rest against the rock to allow them to take new positions. It is entirely wrong, but very usual, to walk up the opposite wall with the feet, and wriggle the shoulders up the near rock in accord. This is wasteful of clothes and of energy, and not so secure in its actual movement. For, on the right method, if the foot against the opposite wall shows an inclination to slip as the shoulders rise, the arms can thrust away from their wall and so apply extra pressure to keep the foot in place, even while they are still pushing the body upward; whereas, on the wrong method, the back has no such elastic margin; it cannot push across and downwards while it is itself moving up. In all such feats the more freedom that can be kept for movement, even at the cost of adopting more exposed positions and of bridging ourselves across intimidatingly wider angles, the greater in reality is the safety.

In narrow chimneys, too smooth for foot or hand hold and too narrow to allow of secure bridging with the back against the one wall, it is possible to move up with the feet pressed flat against the two walls, one on each side: one with the toe pointing up in front of us, the other with the toe down below us; the body is kept upright in the middle on the spring of the bent knees and supported by the pressure of the hands, placed like the feet one against each wall. In this fashion we can 'rock' up satisfactorily. But the method is only safe to practise with soft soles, and it is of course very strenuous.

Wherever possible we prefer to keep outside a chimney, or corner, altogether, and use our feet up the edges of its retaining walls. If we are forced inside, we adopt any sets of holds for our feet up the opposing walls, however wide a split they mean for the legs and however fearsome the depth may look between our feet, before we resort to the cramping, waterworn recess and the

slower method of 'back and foot.' Balance climbers return, as it were, to the gully epoch only under protest and where footholds fail.

Rib Riding. In clambering up sharp noses, flakes or ribs, where bodily contact with the rock is enforced, the same principle of keeping far out and aiming at continuous movement again holds good. To sit close astride, and claw up the rock by means of the thighs, elbows and hands, is customary, and seemingly safe ; but the really safer method, because it admits of uninterrupted progress, is to keep the body away, and to grip with the sole and flexed ankle, or with the knees and sides of the feet, on either side of the rib, or to lock one leg diagonally across the edge so that the foot and knee press against its opposing facets. Meanwhile the hands, holding opposite ways, grip across the edge above. In such a position the body can sink at any instant, for rest, into contact with the rock, and can rise again from the feet, knees or shin without effort. It is useful to remember that when the friction of loosely clothed parts of the body is solely relied upon for hold (as when we are clinging close with thighs and body to a rib), the body always sinks slightly inside the clothes, and has so much the more difficulty in restarting a fresh movement.

Wet Rock. It must be added that when rocks are wet, friction cannot be relied upon, and at the same time the security of foot and hand hold is greatly diminished. Wet rocks may mean slimy rocks, and always mean cold rocks. Cold soon chills the muscles, lessens the sense of touch, and notably impairs both the confidence and the power to climb. On a wet day it is well to carry some spare dry gloves. If, then, we have to make some particularly awkward balance or lift, and the fingers are wet and cold, a fresh glove will give us a few holds of better friction, until it, too, gets wet. In the Alps wet rocks mean glazed rocks, and we avoid them. In our own hills we accept wet rocks as part of the day, but we treat them with an extra degree of respect. Men in soft soles, on dry, hot rock in sunshine, can climb with complete and hilarious security places that rain and wind make it foolish to attempt. For most men the standard of possibility varies as much as 40 per cent. This is never sufficiently allowed for in

youth. Fired by emulation, young climbers arrive in rain where their rivals have passed on sun-dry holds. "A rock is a rock; and, by George, it must go!" is their motto; and if their fortune is better than their knowledge, they accomplish a climb which substitutes a danger happily escaped for every difficulty reasonably mastered by their predecessors.

On the other hand, to accustom ourselves to find our rock climbs, and to climb their wet rocks under all conditions of weather, is necessary training. Provided we allow for the difference in permissible attempt, we risk little, in our small-scale home climbing, by persisting against moderately uncomfortable circumstances. We are the better able to endure them when they surprise us on more serious alpine expeditions. A little adverse circumstance restores much of their original difficulty and adventure to many fine mountaineering climbs too apt to be neglected by modern specialists because of their straightforwardness under sunny conditions. A man who can work cheerfully up an old-fashioned British rock climb against rain and wet holds is a sounder climber than the expert who will only do the supreme 'inventions,' and those only in fair weather for fear of spoiling his record. In this country the finest rock climbs, both scenically and as mountaineering training, are not the most difficult; rather than that they should be neglected, we should seek them and climb them on the wet days.

Glazed Rock.

Glazed rock is its own prophet and policeman. In the summer Alps we need only expect to find it after a snowfall, or where snow commanding rock may have been melted, run down and refrozen. It makes an unexpected and more dangerous appearance when a sudden fall of temperature freezes the mist, fine rain or thawing snow after its fall or as it falls on to the rocks, while we may be actually on them. I know of no more treacherous move in the mountain game or one which calls for more cautious, laborious and ingenious countermoving.

In Britain, as I have said elsewhere, we have to beware of it almost as much, in the winter and early spring months. It may follow a silver thaw, a cold fog or a mist on a change of wind. By starting our climbing early upon hoar-frosted rocks or fresh snow we may

create our own glaze by hand and foot pressure. On really bad film-glaze nothing is sure for hand or foot hold; but a glove or soft sole (not rubber) has a better chance of 'freezing on' than a boot or cold finger. A thick sock, pulled over the boot, will help, or we *may* take off our boots and climb in the safer stockings.

On steep glazing rock, and upon wet rock if its surface grows greasy with the moisture, continuous climbing becomes immediately interrupted climbing. We have to consider the chances of a hold failing or breaking or of a man slipping as increased some tenfold. We must take precautions as for unsound rock and protect ourselves with anchors, belays and the like. However easy the rock may normally be, glaze or grease introduces a new element of 'danger,' and the transparent threat forces us, if we are wise, to treat any moderate climb with the respect due to serious difficulty.

I have only selected for description a few conspicuous features of ordinary rock surface, which might illustrate the underlying principles of a good rock climbing style. Their detail is negligible except as illustration. Climbing situations are infinitely various, and men vary as whimsically in their personal adjustments. Long before he has reached the point of leading difficult passages, the climber will have got his own obstinate idea of how to apply the principles in detail to particular rock features.

Summary.

For the benefit of the less instructed I would only repeat that rock climbing is best learned upon long and varied passages, away from the staccato allurements of boulders, trick climbs and belays. Style is the mastery of rhythmic movement, movement continuously secure and continuously effortless over every modulation of hold during a long day. When a climber can traverse a long ridge of average difficulties safely and quickly, stepping the edge by balance or dropping on either side as he goes and using balance holds with either hand, without check to his party, he is already a safe climber and on the way to be a sound mountaineer. If he proceeds to follow the craft into some of its more ingenious departures, it will only mean a more elaborate application of the same principles that he has already learned to practise: to trust to his feet; to make use of his ankles; to tread lightly and precisely; to keep the hands low; to

choose holds in advance and stick to them; to move well out from the rock; to rely on balance rather than muscle; to make continuous, supple and eventually graceful movement his ideal; not to rest satisfied until he has acquired rhythm; and lastly, never to get flurried.

UNSOUND ROCK

While a climber is still only concerned with perfecting his own adjustments in relation to rock requirements, he will be unconsciously collecting a great deal of practical information about different types of rock. If he is of a curious habit, he will be led on to some superficial study of petrology or geology. But even if he have no memory for names or imaginative grasp of æons, he cannot help gradually amassing a quantity of empirical knowledge as to what kinds of holds to expect if a rock looks so and so in outline, whether to reckon upon finding chimneys or traverses or flakes if its main lines of cleavage or fracture are such and such, and what to allow for in detail according to his distant observation of the general structure and weathering. The discovery of the name of a prevalent rock will tell him what kind of climbing to prepare himself for in a particular district, or the sight of it when he gets there will guide him in the selection and management of his climbs. He may never have been able to master the difference between Tertiary and Secondary, any more than remember the order of the Popes of Rome, and yet have qualified himself insensibly for that most fascinating form of speculative discussion, the designing of new routes in known or unknown districts. On a lower but still more useful plane he will have learned to judge from its general appearance whether rock is sound or unsound, and from its closer aspect where to expect unsound intrusions upon good rock.

The increased information now available about our hills enables us to avoid rock faces of uncomfortable notoriety and to attack eccentric types with precaution. A large number of climbs, even whole mountain walls, that used to be popular on account of the attraction of their weathered angles, are now left for the same reason almost unvisited. But unsound rock cannot always be eluded, and a climber has to be ready to deal with short bands or intrusions of inferior rock on any climb which he does not personally know, and on

many to which he returns for love of their sounder sections. Fortunately, according to the nature of rock, these intrusions are rarer and shorter on steeper rock, and any more considerable section will provide its own alleviation in a relenting angle, where the softer surface has disintegrated more rapidly than its firmer surroundings. This may, of course, mean an overhang, to the climber's disadvantage. If not, it will at least offer him an easier angle for advance over its unattractive trespass. On unsound rock every merit that characterizes finished climbing by balance, or compensation, is emphasized. A novice should never be allowed to lead. A grip climber is a danger on the rope and a suicidal choice as leader.

On bad rock every hold is an object of suspicion, since almost all the holds will be liable to fail under one or another direction of pull. The obviously bad hold, the hold that comes away at the first touch, anyone will reject. But our object on unsound rock is to get over it; and for that purpose to use its holds for what they are worth rather than to start casting them down in an attitude of righteous indignation—and insecurity. With a caressing hand the good climber discovers what pull the hold is likely to be good for, and his judgment telling him the direction and amount of pull that his next movement will demand from it, he will avoid loosening it beforehand by any test not necessary for this movement. The grip climber, therefore, who puts half a dozen directions of strain upon each handhold in any one lifting movement, will make no progress at all on unsound holds. If he does not test them beforehand, in the end he will fall. If he tests them properly in all the directions that his lift will demand, he will remove most of the holds before he can use them. The balance climber, who has practised putting only that direction of strain upon a hold which his own next movement and the hold's security agree upon, is in less of a quandary. For, except in the case of fragments which are already detached, and clearly ready to fall, nearly every surface accident which is still in attachment to the main rock will stand light additional strain in at least one direction. This, of course, varies according to the stratification of the rock and its fractures. As an instance, on a steep

Semi-detached.

face the ordinary lines of fracture may be vertical and horizontal to the discoverable inclination of the strata. If the 'hold' is already detached from the rock on both these lines, and only resting on a support, it is useless. If, however, the excrescence is fractured at its base, horizontally, but attached to the rock behind, vertically, it will be good for a straight outward pull. It can also be tested, but it cannot otherwise be trusted, for a downward or diagonal pull. If it is detached from the rock behind, vertically, but still part of the rock below it, horizontally, it is sound for a direct downward pull, but not for any outward or cross strain. If the strata strike diagonally, and the cleavages correspond, *mutatis mutandis*, the same rules apply for the different directions of pull, permissible or not, upon their holds.

A climber has not only to make sure what direction of strain he may safely put upon a hold, but to keep this direction of pull or thrust constant all through his upward or downward movement, irrespective of the changing position of his body in relation to the hold.

The vital importance of climbing by compensating balances becomes then apparent. A climber who has trained his mechanism to the habit of translating the support of any hold that any one of his extremities engages, by means of the balance of his body, into movement in any direction he requires, has little difficulty in keeping the strain he puts upon a single hand or foot hold constant in direction. He can do so even while he is using its support to lift his weight through a succession of angles past and over the hold. It is, in fact, the process that he has had to learn for his ordinary 'sound' climbing, if he has become a balance climber of precision or pace. A clumsy climber, or one who depends on grip normally, is helpless when faced with handholds of this 'one-direction' kind. He may discover by test how he ought to use them, but the moment the lifting or lowering movement begins the habit of his mechanism will reassert itself, and he will change the direction of his pull as his body nears or passes the hold. Even if he maintains the direction by an effort of will at the moment, his body will not have been trained to carry out the mechanical conversions with sufficient power to overcome the pure difficulty of many a passage, altogether apart from its insecurity. He will be forced to fall back upon

muscle or grip to finish his movement, and the hold may break.

A grip climber who normally neglects footwork is in even worse case on unsound rock, when he has to use, or test, such ' one-direction ' holds with his feet. On unsound rock good footwork is, if anything, more important than good handwork. Only exactly the same strain may be applied by the less sensitive feet, when they take the place of the hands on the hold. Since the downward thrust of a foot can only be slightly modified in direction, this limitation must be remembered in selecting and testing a hold by the hand. Otherwise it may not be sound for the later and different requirements of the foot. Foothold is always the danger-point on unsound rock; and this constitutes the peculiar demerit of such rock for ' climbing down,' when the foot alone must test and lead. A climber, especially when he is descending, must never trust to his feet alone, but protect them by at least one tested handhold. A good rule to remember in all very exacting climbing is that never less than three extremities should have hold. On unsound rock the better rule is, never less than four. The dangerous moment comes when one hand or foot is in process of testing or shifting to a new hold. The movement must be made without jerk; the weight must be distributed between the other points according to their merit; and the direction of the pull, as tested and found secure on each hold, must be remembered. Hence our motion over unsound holds may be properly described as creeping. Every attachment must be light but tenacious, and one tentacle is only released when the others are secure. On insecure rock we are no longer concerned to keep the body as far out as possible. Our object is secure, not free, movement. Consequently, we move with the body as close in to the rock as is consistent with sight and its freedom from catching. If, then, one hold does break, there is less outward pull upon the others, and the body can sink instantaneously against the rock and help to sustain us by its friction.

Small, loose fragments should be thrown well out from the cliff, or tucked away discreetly on ledges that need not be used. Large, loose fragments are best left *in situ*, and the word passed down the line of their presence, until the last man, if he likes,

Detached.

may remove them. Often a block or large stone, which is detached from the parent rock both behind and through its base, may yet afford very sound foothold for a good foot climber, supposing it is seen to be resting on a level and sufficient ledge. The same may be the case with pinnacles or splinters, partially fractured or jammed in cracks. Tested and tactfully used, they are often stable for a steady thrust or pull in one direction at least; but much depends upon the nature of their bedding.

Rock on walls and ridges facing south, in the Alps or at home, must be suspected of detached leanings, until its family connections are demonstrated by investigation. Holds which have been covered by verdure or subjected to the action of moisture in any form have to be judiciously proved. Rocks projecting from ice or snow—those pleasant oases towards which we steer with such relief to ease our step-cutting or snow-wading—must always be approached as unsound rock. If, on occasion, they prove our suspicions wrong, they have only proved themselves an exception to a melancholy rule.

Except on frequented routes, it is never safe to assume the security of big detached blocks, poised on ridges or choked in gullies, unless their fashion of support is absolutely demonstrable. They should be left to the last man to test. From all accounts rash leaders who neglected this precaution have escaped more often and more miraculously than their intelligence, at least, deserved. A leader, if he has any doubt, should avoid touching such blocks altogether. If, for all his caution, a block gives unaccountably, he must hang on to it for all he knows, until the men below have got what shelter they can. Nor must he forget the rope. If the block catches the rope in falling, the danger is as great as if it strikes one of the party.

Apart from these and other permanent idiosyncrasies, most normally sound rock surface will be found to have its times and places of weathering or weakness. We have to learn to recognize the symptoms, forgetting our prejudices in favour of old and trusted rock types, and treat their intrusion with all the delicacy and consideration of tread and touch which we owe to the small infirmities of tried friends.

In so far as they are, or were, rock, moraine and scree may be called unsound.

Moraine and Scree.

The occasional stone on a steep glacier is a find for a foothold; but the stones that coat the ice-core of moraine slopes are merely treacherous. If we have to traverse a few steps on such a slope, it is best to knock the stone out and tread in its ice-socket.

The summit edges of moraines often offer passable going, especially if previous parties have knocked off the final blocks. Their side walls, whether of stone or of stone and mud conglomerate, are the least scalable and most exasperating inclines in the mountain world. They are often even too hard to make steps in, and it is fatal to attempt short cuts upon them.

In traversing along scree slopes, if the scree is small, the one thing to remember is to 'accept the slip'; to place the foot lightly and let it slip till it stops; not to make convulsive efforts to recover it, or to keep the foot up to the same line of traverse. If the foot slips too far on steep scree, lean inward on the axe or stick, which is held point inward across the body. To 'rush' scree on anything but the downgrade is merely to waste energy and time. In ascending or traversing take short steps; tread always for a particular stone, and do not brown the mass of stones vaguely with a loose foot.

In travelling up or along big scree or moraine, balance and a sustained rhythm are the thing to aim at. On flat-stone moraine, step for the middle of the stone; on round or cornered stones, 'dance' from one upper edge to the next. Rather than break the rhythm, if no good hold, or possibly only an insecure-looking block, presents itself for the next foot, slacken the knee and put no weight on the leg while you are using the loose block; skimmer over it with the dropped leg of a horse at a big bank, and trust to the next step to bring you up again. If you balance lightly and move fast, a moving foothold is all but as good as a fixed one.

On moraine the axe is always our third leg of balance. On long moraines, or in traversing up or across scree slopes, it saves labour in the task of choosing stones to follow close behind another man, and let the swing of his feet draw yours mechanically on to the footholds he has used.

To descend light scree is one of the chief rewards of a long climbing day : to descend big scree one of its worst penances. The method falls more properly under the section devoted to Glissading.

Unusual Rock

Unsound rock is counterchecked by an intensification of sound method. To unusual rock we retort by an extension of our usual method. It would exaggerate its importance to discuss its varieties in greater detail than has seemed sufficient in the case of normal rock. A few instances will serve to show that our principles remain, for all rock, unaltered.

Slate has an insidious surface. The exposed edges, or spillikins, of strata may always break under a pull, unless they have allowed us to grasp a sufficiency of thickness. But slate has a worse trick. In chimney climbing, if we are using the usually safe and gentle hold of a thrust with the flat foot, or a press or push hold with the hand, against even a wide, smooth surface, the upper skin may crack locally at an uncertain distance from the point of pressure and allow foot or hand to shoot into space ; and this always, unless the thrust is applied exactly at right angles to the lie of the strata. Our only safeguard is to extend to push and press holds on slate our practice with pull holds in general, and keep the direction of the pressure constant through all our lifting movement.

Quartz ledges and bands, which are the grateful solutions of many of our cliff problems, are treacherous. Quartz brittles off, in crystals or in masses, in unexpected directions. We cannot test it adequately until our full weight comes upon it ; when it may be too late. And so we never step on to projecting quartz, or scale the vertical face of a seam, unless we have hand or foot hold upon good rock above or below it. Happily, quartz seams are usually narrow. We prefer soft-soled shoes, which will distribute the pressure over the uneven facets. Boot-nails snap the projecting crystals or slide on the flat facets, especially after rain. The fingers similarly must take general holds, and not trust to salient prisms. The direction of the growth of the crystals can guide us in applying our pressures.

A seam lying back at a steep angle sometimes leaves good rock holds along its edges, where quartz and rock have weathered at an unequal rate. A seam at a gentle angle as often provides a delightful traverse of escape.

Soft sandstone, which in quarries and elsewhere is frequently used as a practice ground, has its own fashion of soft crumbling and its own body of hardened adherents. Its outlines are recognizable, and in mountain masses we avoid it altogether. But those who attempt it locally must remember that it is peculiarly deceptive for footwork. Its ledges dissolve under a stiff boot. Sand shoes, or still better, boots, are the only wear. Beginners should look for lines of ascent where the subjacent heaps are still uncarted and propitious in the event of failure. Old sandstone, when it emerges, is firmer for the feet but offers little handhold, and makes very fatiguing climbing.

Chalk, and the methods of dealing with it, form a study by themselves. Chalk climbing provides the missing link between rock and ice technique. Those who frequent its cliffs use big claws and ice methods, and pronounce it to be an unrivalled training for ice work. Its occasional hard surface and its abundant projecting flints, whose security is in inverse ratio to their graspability, have to be treated with the measures of precaution proper to unsound rock.

Marble builds peaks of imposing outline, but its edges are not constructed with an eye to good foot climbing. Its surfaces, where exposed, slope against us; its slipperiness dictates the use of soft soles; while the rubble with which it is cumbered makes soft soles comfortless. It has appeared to me more often dangerous than difficult.

Old lava is as tiresome as quartz, and less often available as a last resource. Desperately hard for the feet, it yet snaps out in diamond cubes and litters with wrenching rubble its already jarring surface. I know of no sound climbs upon it.

Gritstone has its own devotees and a growing literature. Its climbs and their mosaic perils have all the charm of a well-executed miniature.

Limestone, as the layman uses the term, is deceitful, and offers ridiculously little good climbing in proportion

to the amount of it that protrudes plausibly from the surface of Europe. One of the closest escapes I have experienced was from a spontaneous fall of limestone rock on a venerable and bland-looking western cliff. In the form of 'dolomite' it offers very agreeable sharp-edged dwarf-climbs even in our islands, and it is to be regretted we have so little of good stature.

In Quarries.

Scrambling in home quarries, on chalk, gravel, blue-stone,—all kinds of rock,—is excellent practice. The surfaces are, however, raw and untempered by time, and the crude fractures and ledges by which we climb are made by man and survive by no natural law of the fittest. No experience of rock structure can therefore suffice to allow of calculation upon their security. Each hold must be separately tested before use. The risk is generally out of all proportion to the height. A rope from above should be used on any passage of doubt.

Along Sea Cliffs.

Sea cliffs have many votaries. It is perhaps ungrateful to class them as unusual rock, but their unfamiliar conditions, their wave-polished and often undercut bases, their summits artificially sculptured and constantly strained and fractured afresh by the fall of the cliff below, exclude them from a normal category. Their charm lies in their variety of rock, revealed in forms pensive, brooding, surprised, jovial or defiant, upon headland, island and stack. There are few more exhilarating scrambles than the granite outcrops of Cornwall, set in green seas, surf-spray and sunlight. The upper end of the coast of Sutherlandshire alone provides eight or nine different varieties of rock, and therefore of ascents. The whole island of Sark can be circumambulated at about the mid-height of its cliffs.

Traverses are the peculiar property of sea cliffs, which are often awkward or impossible of approach from their base for more direct ascent. Whole days, in fact if it were desirable a whole holiday lifetime of delightfully varied traversing at different levels may be had along the cliffs, high or low, of the west coasts of Scotland and of its islands, of Ireland, of England, and of parts of Wales. The north coast of Ireland has attractive sections alternating in this instance with pinnacles and

scarps of decadent blends. Usually the return from such traverses can be made in the evening up a gully; by which we resume, if we wish, on the morrow. As a last resource in difficulties there is always the sea for a header of escape.

Rubber soles are the best wear; or, for some varieties, raw soft hide with the hair on, as worn in the west of Ireland; but rubber is, of course, treacherous on wet or weedy tidal rocks. This fact should be remembered in our stimulating races with the waves for the foot of a promising crack.

During the novitiate even hardy heads must beware of the intimidating, often vertiginous, effect produced by the constant movement of water below the feet. Both the sound and the motion are found to react almost unconsciously upon toughened climbing nerves.

The cliffs of the east coast of England consist too often of subsiding clay and water, or of a hard pebbly conglomerate; but they provide at least unusual climbing.

A good earth glissade can occasionally be found down their rifts; and every section affords opportunity for a cautious scramble or an ingenious trick route. On the harder earth and pebble mixtures there is sometimes occasion for step-cutting practice. The cliff edges frequently overhang, and present all the dangers of unseen cornices if approached from above, and more than their difficulties if reached from below.

Boots are best on these east cliffs. Vertigo is unknown, since the waves are all too rarely in close proximity to the cliffs!

Ireland, on the east, is more fortunate; it possesses some fine firm stacks and cliffs. Parts also of the east cliffs of Scotland are excellent.

Some regions are rich in incidental pillars, pinnacles, stacks, needles, pins, fingers, boulders, erratics ('off-comduns'), Wellington's Noses, Grey Ladies, Devil's domestic utensils, or their fantastic like. It is difficult to connect the records of their (periodic) first conquests with any general principles except those forming the groundwork of a local literary reputation. A long rope over the summit would seem to be the preliminary to many such a climb, and statuesque photography its culmination. But between these extremes a peripatetic climber can find many

On Freaks.

joyous and gentle passages, where he may even remain anonymous if he goes armed only with such sound method as the type of rock suggests, and shod with soft soles. One experienced companion would be found of more service than many onlookers; and a tradition of classical mountaineering demands that the rope between two men should not pass over the summit before either has started. To save time, once, when we were crossing a series of smooth needles two of us agreed to climb continuously, in the hope that if the man descending on the far side of one needle slipped (as was the more probable) the man on its near side would be assisted to the summit more quickly by the rope; and so no impulse would be wasted. Unhappily, it was the rear man, ascending, who slipped, and at a moment when, owing to the length of the rope, the front man was already himself ascending the next needle. Neither, at all events, was left long in suspense.

Bouldering is the pleasantest of off-day distractions; but too many men allow themselves to spend the time on the merely difficult. Its use should be for safe exercises on rules of style. When you can climb an easy block without your hands, or balance up a wall with such light finger-hold that a friend can pass his hand under yours, or have discovered how to solve a shelf climb by a push hold and a twisting arm-lever, you have made a fair test that will be of future use. To wrestle up pure difficulty, such as you would not attempt in exposed higher climbing, by dint of muscle and strenuosity, proves nothing and does no good; it only reduces the restful value of the off-day. Our object on such unusual rock should be to extract from it the soundest practice for our usual method.

CLIMBING DOWN

It is more difficult to climb down than to climb up. So long as the majority of rock climbers continued to grip and struggle, they could find no pleasure in descending. The characters of our hills abetted the neglect. The labour of the day went in finding the steep climb and then forcing a way up it; there remained for the evening too great a choice of easy slopes to run down. Even in the Alps the habit followed the early rock climber; he was too ready to choose a peak "which would give plenty of sport on the ascent, and an easy snow-route down." During our gully and grip epochs, when this self-imposed limitation was almost universal, rock climbing reached its furthest point of divergence from real mountaineering. The development of balance climbing perforce broke down the tradition. Climbing down had to be learned when really big mountaineering was attempted. Where mountains have no easy ways down, it is as important to be able to descend as to ascend. On new or difficult climbs the method and time-calculation for a return in case of failure call for more forethought than the ascent itself.

But beyond this, climbing down was discovered to have its own pleasure as motion. A good climber in training, and descending upon rock that gives continuous hold, enjoys a sense of swift restrained rhythm, and a rushing thrill through his own extremities, that has something of the pleasure of flying and a pleasure from quick light contacts that even flying does not possess. His hands and feet appear to adhere almost accidentally underneath him, like the spokes of a revolving rimless wheel. They move across a sound hold with his change of balance rather than check him at each contact. His eye has selected a whole succession of small holds ahead, or rather afoot. He balances down them as a complementary sequence. He does not ask of every hold that it should become the basis for a fresh beginning. 'Touch and pass' as contrasted with 'grip and hang' perhaps sums up the method.

Of course each hold must in itself be adequate to check and direct the passage of the body, otherwise momentum is acquired, and the method might be defined with justice as only a fine fashion of falling. The check is distributed over a series of holds, each of which serves only to retard the downward movement just sufficiently to direct it, with no acquired impetus, on to the next hold. The holds on such a passage complement one another. Each is used transiently but safely, because the action of the next is anticipated. The definite arrest-points of course occur, but they are selected by the eye at longer convenient intervals.

To read rock holds and their balance values ahead in this fashion requires a more practised eye and judgment than were needed merely to decide on the reliability of the next grip hold. It was this art of the longer glance, the practice of descending as a regulated movement rather than as a succession of stances and rests, which rock climbers neglected, and still too largely neglect. The shortness of our island climbs, as our young climbers increased in numbers and in ambition, drove them to the discovery of a rapid progression of more and more difficult variations. These climbs could not be ascended 'continuously.' The art of continuous up-climbing was almost forgotten, and with it disappeared any idea that continuous down-climbing need even be practised. The strenuous up-climb exhausted our interest in a particular series of problems; the prospect of a similarly 'interrupted' descent of the same places seemed rather boring; in fact, we preferred to run down an easy way, and begin upon a new ascent of new problems. Climbing down joined climbing continuously, up or down, in a limbo, from which it had to be desperately rescued when we went to the Alps or to regions of longer climbs.

Some years ago, on perceiving that the neglect was spoiling the style and achievement of climber after climber of the British school who came out to the Alps, I ventured to publish something of a protest. Happily this made a few important converts. And now it would appear that the evil spell is broken. No good cragsman would nowadays seem to be happy until he has done his fine rock climb both ways; a few are beginning to specialize upon descents. The admirable practice of

traversing or ' girdling ' great cliffs, which involves the ascent and descent of the steepest sections of many difficult climbs, has finally placed climbing up and climbing down on a footing of mountaineering equality. It may be said that this result was inevitable once balance climbing had come to its own. Once the eye and the body were set free from their confining and convulsive habit, it could not be long before hands and feet opened up the new ways of pleasure in moving downwards and sideways as readily as upward.

We have made a great step in advance : we practise climbing down as an art in Britain, but we have still a long way to go in developing our practice of ' continuous ' climbing, down even more than up. I have seen the start of many of our finest island rock climbers in the Alps, men whose feats on difficult rock still stand unsurpassed, and I have never seen one who, when he came out, was even the equal of a good average guide in continuous going on moderate or steep rock, especially in descending. These men quickly recognized their defect when they saw the styles contrasted, and set themselves to correct it. But others, who have gone guideless and never enjoyed the opportunity of comparison, have continued even in the Alps their interrupted method and, consequently, have achieved a degree of performance in no way equal to their real standard of climbing ability. A very illuminating instance was that of one of the greatest of our rock pioneers, whose style was as finished and deliberate as his enterprise was remarkable. After many years of climbing in our islands, with an unrivalled record, and of climbing guideless in the Alps, with practically nothing to show for it, he spent one season, later in life, with a fast first-class guide. As a result he, admittedly, changed his whole habit, and subsequently climbed with an accomplished continuity that without diminishing his security multiplied his amount of performance three and four fold.

Climbing down requires more practice than climbing up, because the mechanism of the body is contrived more conveniently for upward movement, and because we have eyes in our head and not in our toes or heels. The eye has to learn to select its holds from awkward angles. The hands and feet have to learn accurately to follow the eye's choice, in movements mechanically

more difficult to execute. Consequently in descending the inclination to grip and hang becomes even stronger than in ascending, and until the right attitudes become instinctive it requires some resolution to force the body steadily outward until it is in balance over its footholds and is not depending from the hands.

Once the natural impediments are mastered the gain to pace and to security which we obtain from our balance and foot method soon makes even the memory of our desire to cling strange. The muscular strain is less. We are free to use the friction of the body, in any part, to regulate the pace or suggest direction. The body descends naturally on to firm positions on the feet, and stands ready without readjustment of balance or holds to give any assistance required to the man below on the rope.

It is on continuous descending, and on the management of the rope this involves, that the improvement in our method has had most effect. The principle of descent in balance is to keep face outwards or face sideways as long as possible. In such positions our eye commands both the whole rope and the rock almost continuously, and we can decide at any instant whether we should proceed, or pause, or tauten the rope on the man below.

It is almost startling to see a first-class mountaineer come down steep rock, as last man, in a series of well-timed rushes, while he still protects the continuous descent of his less expert front-men. He never allows the rope to slacken. He keeps the safety check while the man in front is moving; but in any intervals his lightning rushes make up the necessary ground.

In descending, a slight tension of the rope is sufficient to check a weak climber, whereas in going up he would have required a hard pull; and a light guide or a quick amateur, judging his moments well, can 'anchor' and secure the safe descent of a whole rope of heavy-weights below him, and yet never check their progress while he interpolates his own flights of descent.

Positions.

In descending, so long as is conveniently possible, and practice alone discovers how much longer the position is tenable than appears to us at first, the face should be kept turned outward. So soon as the outward position becomes insecure,

that is, when nothing but holds for the heels present themselves and the balance is felt to be thrust out by the steepness of the rock beyond the feet, thus throwing a clinging strain upon the hands, the body should be turned sideways to the rock.

Only as a last extremity, on perpendicular or overhanging rock where the eye is no longer of use to find footholds, should the face be turned in to the rock, in the position most natural for ascending.

Facing Outward.

In the face-outward position the action of the feet remains still that of the balance step. For easy movement footholds should be selected, if the choice offers, outside, to right and left of the vertical descending line, rather than directly below the body. The legs are used as tense springs to break the jar. In fact, the motion is that of 'dancing down.' The heels are little used; the toes and sides of the feet take the holds, much as in ascending. The hands have to find their hang holds or pressure holds at the level of the thighs or knees. For the hang holds the knuckles are turned backwards, on either side of the body, and the fingers grip the rock much as in ascending. For the pressure holds the heels of the hands are pressed downward on to the ledges, close to the sides, and rest in the position of a reversed push hold. It should be remembered that this last fashion of hold, always the most tempting in starting a descending movement, becomes useless and even dangerous because of the outward thrust of the arm, so soon as the waist has sunk below the level of the hands. For this reason, before lowering down on this hold we must make sure that the reach for the leg to the next foothold will be short.

In the face-outward position the hands can be relieved of much of their effort in holding by the backward or sideways pressures of the calf, of the back of the thigh, or even of the elbow or shoulder, against the rock. A twist of the firm knee in a convenient angle of the rock, or a sidelong 'steady' with the heel of the firm foot against the back or side of its rock hold, gives us often balance enough to allow the other foot to descend without using the hands at all. This is what is really happening in the 'rushing' movements alluded to above. The expert is using any and every part of him,

from ankle to elbow or shoulder, for friction and balance touches while his feet descend; and consequently he has both hands free to tighten or pull in the rope as he goes, even in mid step. The eyes, since they can see uninterruptedly, guide the feet accurately. Elbows, legs, thighs, etc., by judicious touches help out the balance and relieve the hands to a large extent for other work.

The sideways position, which is admirably adapted for balanced climbing, is still all too seldom practised.

Facing Sideways.

Climbers instinctively turn face inward the instant the holds get small or the rocks steep. But to turn sideways is safer, because the eye can see both holds and rope, and the body is in a good position to adjust itself for anchoring; it is better suited to the normal lie of holds, because holds rarely occur in vertical sequence on rock, and a diagonal descent is often possible where direct descent is interrupted; and it is more in balance. For in the sideways position the single hand employed takes the natural hold, such as it is accustomed to use in ascending: either a cling hold, or even more often a lower push hold reinforced by an inward curving of the arm towards the rock as a lever. The outer hand is left free to manage the rope or to use the axe. The feet fall naturally into position on the ledges, with the side of the foot, and not merely the toe, on the hold. The flex of the knee and thigh works parallel to the face of the rock; and neither the bending of the knee, as happens while descending face inward, nor the curve of the flank, as in descending face outward, can get in the way of an easy lowering of the body above the firm foot. The climber also, as he leans out to the full length of one arm, is far more free to prospect his descent in advance. Lastly, while actually more comfortably balanced, a man so descending is in a better discretionary position to adopt any alternative attitude, face inward or outward, by a half turn on the foot, according as his larger range of vision advises.

In traversing the big ridges or crossing the great rock faces of the Alps a large proportion of the climbing must be done in this sideways attitude. Economy of effort, ease of balance, and the carriage of rope and axe in a free hand demand it. The technique is one that it is essential to master, and once acquired it will be found

to become the normal position for pace and comfort in descending.

It is the exception when the conditions make it imperative to turn the body face inward. The occasions are the descent of vertical or rounded convex surfaces, of overhanging 'cave pitches' and the like, where the holds do not permit of an upright or balanced position, and where the legs have to be swung in underneath and out of sight in order to find the next holds for the feet.

Facing Inward.

Here, if it is more than the question of a step or so, there can be no question of the whole party moving together. The rope is therefore dropped from the hand, since both hands will be needed to lower the whole weight during the movement. As soon as the feet can find hold, the balance should be readjusted upon them, and the eyes set free to look round again and prospect. Even though it may appear to be more comfortable and safe to continue in a jammed or face inward position after it ceases to be absolutely indispensable, the inclination should be resisted. The longer the duration of the face inward descent, the longer must continue the interruption to the advance of the whole rope.

It is one of the principal objections to this position, which is individually safe enough, that it necessitates an interruption and break of rhythm for the party. Climbers, from an instinct of safety, turn into it too frequently, and continue it too long, in places where a sideways descent if the problem be a slab, or a face outward straddle if it be a steep chimney, would be the correcter and quicker method. It is not only retarding in its effect on the rope, it is always slow in actual performance. Men move into it ponderously and reluctantly if they have been face outwards before. They continue in it slowly, because they cannot see and are using clinging methods; and a natural reluctance to take the slight risk of turning round again before they have reached a large 'turning' stance makes them keep the position usually longer than the difficulties demand. Meanwhile the whole party waits.

If a man is a practised sideways climber he can turn into this face inward attitude when necessary, and out again the moment he finds balance foothold, with a

minimum of check to the rope. From a sideways position he has only got to bring round his other hand, and he is ready to climb face inward for as long as he has estimated will be needed.

Down Chimneys or Cracks.

In jamming down chimneys or cracks the face outward or sideways positions are always to be preferred. The eye, free to select, can generally find footholds close or far out on the side-walls, which would be invisible to the face inward position. If these holds fail, the jam with outstretched arms, or knee or thigh or shoulder against the containing walls, is still always safer for a man in the outward and sideways attitudes, unless he be on an absolute overhang. At the same time, since his hands are free in descending sideways or outwards, he can still manage the rope even in his moments of descent, and so save any check to the progress of the party. Whereas in the face inward position the hands are useless except for holds. I have seen a guide serpentining down a crack of this sort, face outward, by the pressure of his shoulders and thighs against the walls alone. The fact that he was free to watch the party even while he moved down enabled him to anticipate the slip of a climber below; and he took the whole pull upon one quick outward pressure of his knees and arms against the side walls. An average climber, with the slightest of holds for his feet, in this attitude can hold practically any usual weight. It is a question of balance and judgment.

The Rope in Continuous Descent.

To secure the safety of the party on the descent a right position will do much. A man who climbs face outward or face sideways is ready mechanically to take a very considerable and sudden strain. But a right use of the rope over the accidents of the rock will enable him to do still more. On steep or unsound rock we are always on guard against the unexpected slip or the breaking hold. Therefore, while on the rope, we note at every step how we are placed to take a jerk. If we are all moving together down steep rock we note, as we pass, every corner or point round which we could with a single motion of the hand throw the rope as an 'anchor' in case a man below us slipped. If we are all moving quickly, and therefore presumably a safe party, we need not do more than note

them. But if the party is weak, or we are moving interruptedly, then, no matter how easy our own sector, we should not only note but use points suitable for the anchor.

It must be remembered that such anchoring on a descent is designed to assure the balance of the stationary man, in case of a sudden jerk; and only indirectly to support the man descending below. The actual pull of a slip, if it comes, should be taken up on the arm, but never directly on the rock anchorage. It is useful for every one to practise this cursive anchoring on any descent which is too steep to allow of the party moving really rapidly together. There will be time then to swing the rope over and off the points as we pass them, without check. Once the trick is acquired, the eye will go on instinctively always selecting the anchors, but the actual movements we can discontinue. Habit will at once make the movements actual again wherever expedient,—on all descents of medium difficulty, or on easy descents where a slip might have dangerous consequences, such as the edge of a lofty ridge, or an easy gallery above a sheer wall.

The Doubled Rope.

It is a sound general rule that a climber has never been justified in going on up where he finds that he cannot get down without fixing a rope. Now that good cragsmen consider nothing mastered unless it has been climbed both ways, the occasions for the fixed rope are or should be rare. But there are exceptions, and in such cases we use the 'doubled rope.'

The first would be the case of a party descending by a line which they have not previously ascended, or which has never been ascended or descended at all —a not infrequent experience in making new traverses of peaks. In this case a doubled rope may be the only method of descending a holdless passage. But when he employs it in such places a climber is again taking a serious responsibility, supposing that he judges it to be a place which he could not reascend. He must be certain from observation that the rest of the descent will go below, or he will be cutting off his retreat unjustifiably. If he cannot make sufficiently certain, the doubled rope should be left behind so that the reascent may be possible if a return becomes necessary.

The second exception is the change that is often produced by a change of weather. A fall of snow, or an ice-glazing on the rocks, may make a descent both difficult and dangerous where the ascent on dry rocks was sound. In this case constant use of the doubled rope may be the only chance of ensuring a safe descent. Such changes are not infrequent in the British Isles as well as in the Alps, and they are the most trying occasions in a mountaineer's experience. A picnic ascent of an easy buttress may be, and has been in Wales, turned by a light shower of rain, freezing immediately into a coat of verglas on the rocks, into a dangerous duel of descent against darkness and difficulty; and a joyous frolic up the walls of an aiguille above the Mer de Glace, owing to a hailstorm that coated the rocks with freezing particles, has become a prolonged wrestle with fate, demanding painful hours where the ascent took minutes, and necessitating the descent of almost every foot of the thousand-metre wall by each man in turn on the 'long rope' or the 'doubled rope.'

The third exception is when it is necessary for the last man to save time in a race with darkness. Then, after letting the rest down, he follows on the 'double' as fast as he can.

And the last is the rare case when it is expressly intended to force the descent of a passage which has defeated all attempts to ascend. In such case we use all the help that we need for safety.

The double rope can be used in these cases of difficulty or haste to assist the descent of every member of a party. Usually it is only to protect the last man.

The method of using the 'double' is to lay the rope round any point or knob which prevents it slipping off under an outward and downward strain, and from which it can be conveniently released by pull or flick from below. If such a generally comfortable point is not discoverable, a length of the rope should be cut off and knotted into a secure sling, which is wound in a triple coil round any excrescence good enough to hold it permanently secure. The triple coil cannot break under the friction, and allows the rope to play through more easily. The rope to be used is then passed through the sling.

Some climbers carry ready-made slings; others favour iron rings, which they slip on to the slings, and then

pass the rope through the ring. The rope runs more easily, but I have never liked the practice. A ring can never be carried of sufficient size to use on more than a single thickness of rope, to say nothing of a safe triple sling. And not only is the single sling more likely to snap under the rub of the hard ring as we descend than under the more springy pull of another rope passed through it, but if left it is more likely to be a danger to the next party descending. Guides are always ready to use a finished-looking piece of mechanism, like a ring on a loop, without testing it fully, where they would be suspicious of a mere weathered sling of rope. The metal reassures just where it should warn them; for the ring, where it touches, will have rusted into and eaten the rope strands. The same point comes up under the heading of Pegs and Aids.

It must always be remembered that the use of the sling or ring involves unroping, which the 'double' on a good belay does not; and in so far it uses more time.

For short descents the last man can use the slack of the rope between himself and the next man as a double, provided he sees that, when doubled, it will allow him to descend as far as his next stance, and there leave him slack enough to flick it off the belay.

He should always use the double as a fixed rope, that is, it should never be paid out to him round the belay, as he descends, by the man below; nor should he ever attempt to pay it out to himself as he descends on the double. Either attempt will certainly fray the rope round the belay, possibly jam it, and probably jerk it off the belay.

For any considerable height it is better to use a spare doubled rope. In this case the last man can at once see if the two ends of the double reach to the next stance below. If no spare rope is available, the next man below may have to unrope, in order to leave the last man enough to double and descend upon.

If the descent is of exceptional difficulty, e.g. an overhang, a spare rope should always be used. The second, or climbing, rope round the last man's waist is then held by the man below, as a protection in case the effort of clinging to the double exhausts the last man's hands; or, still better, it also can be laid over the belay and paid out to him, lightly, as he descends. As it will

then be sliding upon the fixed rope, and there will be no strain upon it, it will be the less likely to jam on the belay, fray or jump off.

To descend on the double the last man grasps both ropes in his hands immediately below the belay, drawing them taut before he starts to see that the belay is rightly arranged for the strain. He descends, using what footholds he can on the rock, or, failing them, by frankly swarming down. If he is unroped from his party, and using the only rope as a double, a protection in case of a slip is to tie both ends of the doubled rope to his own waist before descending. The arms in such descending should be kept bent. The most trying point is just before he reaches the stance, where the double ropes are resting on the ledge and are no longer kept taut by their own weight in suspension. If the climber is using one of the leg brakes below described, its tension will still keep the ropes taut for his hands. If not, and he is descending by hands alone, finding what foothold he can upon the rocks, he should get the man below to pull on the ends of the two ropes and keep them taut till he is down. If he is descending first of the party, and therefore there is no one below, a convenient device to the same end is to sling his sack down on the end of the ropes and leave it just suspended.

Brakes.

Gloves protect the hands; but long descents are often too great a strain for amateur fingers, and the chance of their slipping or cramping cannot be risked. In this case one of the following leg brakes should be used. Experienced climbers always use them where footholds fail, for however short a distance.

The Foot Brake.—This is the commonest device in gymnasium rope-climbing. The body is turned sideways to the rock, the double rope inside it. The twin ropes are caught up under the sole of the inside boot and out over the instep of the outside boot. The boot edges are clenched upon the ropes between them, and the amount of friction over the boots resulting allows the weight, with small effort of boot clenching, to slip in easy control down the ropes. The body is kept upright by the hands grasping the rope above.

The Thigh Brake.—This is the most frequently used in the Alps, as rock descents are seldom entirely vertical or overhanging, and a sudden extrusion of rock under

the feet when using the foot brake upsets the balance; whereas with the thigh brake the body can lie sideways against a projecting or convex curve of rock, and slide down the boss, swinging to the perpendicular again where it ends, without effort at balancing. The right method is to turn sideways to the rock, slightly raise the *outside* thigh, pass the double rope under it high up between the legs, and grip the farther lengths of rope so passed with the outside hand, palm upwards. The inside hand grasps the tightened ropes above, with bent arm, at about the level of the head. The outside hand, by lowering or lifting the slack lengths below or above the level of the raised thigh, diminishes or increases the friction of the rope round the thigh, and so controls the pace. If a complete rest is needed, the outside hand merely brings up its double rope to join that held by the inside hand, and a very light clasp of the two hands together on the four ropes so united, aided by the almost total arrest of the rope passing under the thigh, easily stops the descent. It is a mistake, but a frequent one, to start the rope round the *inside* thigh. Round the outside thigh is safer and more comfortable; and it leaves the inside leg free to use any foothold that turns up.

The same fashion of brake can be used under the foot instead of under the outside raised thigh. But this necessitates holding the leg very rigid, and makes it more difficult to balance. Nor does the rope run as smoothly under the boot as under the thigh.

The Body Brake.— This brake, which has several variants, need practically never be used. The amount of friction introduced demands of a climber almost more effort to push his way down the rope in constricting jerks than he would use in swarming down it without a brake at all. The simplest form is to pass the double rope under both thighs slightly bent, back, across and in front of the body, and out, round and behind the shoulders, to the control of the outside hand.

The Chair.—As I am dealing with these devices, a note upon this may not be out of place. Except for an injured man it can rarely be required in descending; although I have, on occasion, employed it for a beginner who could not be trusted to manage any form of brake that left anything to his discretion. But it may be found

of use in excessively difficult passages of ascent, where the leader has only got throughwith great difficulty and where the possibility of a less brilliant member of his following having to be hauled up clear on the rope and remain suspended for a perceptible time makes it necessary to find some sort of attachment that will not suffocate him. Men vary in their resistance, but no man can hang clear, on a rope tied round his chest, for more than two minutes without partial suffocation and considerable pain. In ascending, both hands are needed for climbing, and no form of the usual descending brake is therefore suitable. The chair is formed by making two easy loops for the thighs opposite one another on the rope, secured by a sound central knot (triple bowline). Through these loops the climber passes his legs, as through breeches. If he then straightens his thighs, he can sit in easy balance in the loops; but as security against falling out backwards he should knot a scarf or cord round his body and make it fast to the main rope in front of him. In this chair he is perfectly free to climb and use his hands and feet so long as they help him; and when he slips off, he swings comfortably clear in his loops. He has only to remember to keep his body and thighs straight, so as not to sag backwards and downwards out of the slings. The men above do the rest. The chair is much used by bird's-nesting cliff climbers, who desire to keep their hands free, and who may have to remain suspended for long periods.

Springing the Rope.

After the last man is down on the double rope comes the crucial moment, when the rope has to be run or 'sprung' off the belay from below. Nothing is more irritating, or of more frequent occurrence, than to find that the double rope, after running a certain distance round the belay, has stuck, and that a laborious and often hazardous reascent, trusting to its partial attachment, is necessary in order to release it. If the belay has been well chosen, or the sling well fixed, it ought to run without difficulty. To pull it off without hitch it is essential first to see that there is no knot in it, especially at the running end, where the fatal knot beloved of guides and many amateurs, for purposes of their waist-noose, generally lurks as a permanent threat.

The rope should be pulled round the belay slowly

but continuously at first; any re-start implies a dangerous jerk that may entangle the loose end as it jumps about. The last ten feet are the danger, for the short, swinging loose end may at any second jam or catch round the taut rope in its dance. To break any slight friction or hitch, and give the end of the rope a springing release from its belay, these last few feet should be rushed with a sharp continuous pull by two or more of the party, who must then look out for their heads!

If there is not sufficient rope to allow of its being used as a double rope down the whole descent required to the next stance, it is possible to attach a ring to one end, and, putting the end with the ring round the belay, to pass the hanging rope through the ring, making a sort of running noose. The rope is then used as a single, not a double, fixed rope for descent. To loosen it afterwards, it is necessary at the start to tie an equal length of light cord to the ring. This is pulled from below, dragging the ring downwards and the rope after it round the belay. I have never liked the method, and never seen it work properly. It incurs all the disadvantages of the rope jamming, and of the single sling breaking, and gives only a single thickness of slight alpine rope to climb down. It is very rare that a climber cannot reach some sort of a stance by using all the rope he has, as a double, even if he has no spare rope. If he has, for security, to let the rest of the party down farther to some larger platform on the whole rope used as a 'long rope,' as last man he can usually find some half-way stance sufficient to let him pull the 'double' down after him. He can then refix it, or, failing a belay, descend the rest of the passage without the double, first roping on again to the men below, and directed and helped by their advice as to his holds.

The Long Rope.

It infrequently happens on big descents that weather conditions, giant slabs or deciduous holds make it necessary for a party while descending to move down greater distances, in order to find safe stances, than their allowances of rope will permit. Sometimes each member of the party will have to be lowered a hundred feet or more, not once, but several times in succession. This does not necessarily imply that no holds are to be found over all this distance, or that the individuals are not able to climb much of

it unaided. But once unroping has become necessary, and the time it takes is lost in any case, it is quicker and safer to let each man down the full length of the whole rope at once, so as to reach some really secure stance where he can stay unroped in safety while the next descends. The whole object, then, should be to save as much time as possible. The best way is for two men to remain in charge of the rope above, one directing and lowering, the other anchoring and paying out. Neither of them need necessarily be attached to the rope, provided it is well secured. The moment the man below reaches safety he should untie, without losing a second. Meanwhile, the next man to come can already have tied on to the other loose end above, and be beginning his descent. While one man above holds him the other pulls up the loosened rope from the man who has finished descending. If the rope is long enough, and the men prompt and not 'loose stone kickers,' two men, at sufficient intervals, can be descending at the one time, on either end of the rope; while the two ropes are managed, one for each of them, by the lowerer and by the anchor man above.

(In descending easy rocks with two beginners or weak climbers, a variant on the same method serves excellently to save time. The expert ties himself on to the rope between them, and lets them both descend, at intervals, ahead of him. He holds both their ropes meanwhile, and he follows himself when they reach security. The same economical method can be used in ascending easy rocks with a like party.)

The last man, when the party has used the 'long rope' and the rocks baffle even *his* skill in employing short, crafty 'doubles,' does best, if he has a good second, to keep him close to him when their turn comes to descend. He lets the second down to the neatest place he can stand at all, and uses a double or a shuffle down to him, helped by his directions or arms. Two good men thus weaving spells together, and keeping the cauldron bubbling, can shepherd one another down passages of toil and trouble where a last man would require constant 'doubles' to help him, but would conjure them in vain alone; and where the rest may have had to submit to the full witch-dance of a descent upon the long rope.

PEGS AND AIDS

Artificial aids have never been popular with us. If a climber does not feel safe in descending, he ought to practise on rock which he can climb, not spoil rock which he cannot with blacksmith's leavings. If a security greater than rock can afford him remains his object, it would be more consistent to fix up a ladder or windlass at once. I am told that a delightful contrivance—a pulley or block—has been advertised, which enables the climber to haul himself up or down without effort. As to how we may fix the pulley to draw ourselves up, or unfasten it after we have descended, we have clearly only to adopt the method followed by Baron Munchausen when he descended from the moon on a short rope—and the thing is done!

For those who cannot climb down in Britain there is always an easy way round. The only two pegs I can recall having seen in our hills were left by two foreigners, and were not needed.

In big mountaineering there may be more excuse. A descent may have really become more difficult, even unsafe, owing to the coming on of darkness or the glazing of rocks.

In such case, pegs to hammer in and anchor to are a remedy for our failures, our failure to carry on, to adjust the climb to the day-length, or to watch the weather. Their use then is corrective, not auxiliary. My party has taken pegs three times in all, as a precaution, and used one once (on a new descent where the precise 'impossible' passage had been previously located). Pegs taken for this purpose should be short and sharp, and sheathed for carriage in pocket or sack. They should be made with a ring or eye to pass the rope through. They are smitten in and out as convenience and the rock dictate.

Pegs should never be left as memorials. Prongs and rings poked permanently into popular routes are more harmful than helpful. The mountaineer will not need them, and they may mislead him, as they usually follow the best lowering rather than the best climbing

line. Where fixed irons are placed with fixed ropes attached, as on the Matterhorn or the Dent du Géant, they spoil the climber and the climbing alike. They attract feckless folks on to the peaks, and torment them with the rock-barrages of pantechnicon parties or the stonier sharp-shooting of daft solitary scramblers.

On the rock peaks of the Eastern Alps, however, the peculiar character of the climbing has created a different tradition. Already a large literature has grown up on the subject of mechanical contrivances for descents. Pitons and ring-pegs and slings are taken and used to an extent that almost relieves a climber of the need of considering his descent at all. A practice which is sanctioned by many fine cragsmen who have developed their methods to suit their own type of rock, and not ours, must be respected in its own territory. But just as among our own countrymen the over-use of the rope and of belays has contributed towards a diminution in individual responsibility and to an increase in ill-chosen associations, so also the opinion suggests itself that the over-use of pegs and other contrivances by our colleagues abroad has led to a recklessness in leading and a disregard of what we mean by collective safety and power, which have proved even more fatal in result than our own error. Recently among the best continental experts there have been indications of a change of doctrine. They are finding, as we did, that the neglect of the art of *climbing* down is a definite bar to achieving success in greater mountaineering.

There would be no purpose in discussing the technicalities of a practice so little likely to be popular with us

In ascending, a peg is no protection to a leader, although its insertion may tempt him perilously to go beyond what he should. His second man, 50 to 60 feet below him, can give him as much 'safety' with the rope as a rigid peg 10 to 20 feet down. If he has room to drive in a number of shorter-distance pegs, there should certainly be room for him to have up his second man. If he has got to run out more than the 50 to 60 feet before he can get a stance, it is useless to waste time driving in a peg; no rope light enough to run out in this way could be trusted to stand the jerk of a fall of any height upon a rigid bar or ring.

On long horizontal or diagonal traverses on very steep

rock, pegs may have a purpose, as a moral support to the leader; although, if he is free to hammer in pegs and loop ropes, it would probably be better for him to get on with his leading and get it over. On such a traverse also a peg may serve to carry the rope, and relieve the waist of some of the drag from the lengthening run-out.

A peg is really only 'sound,' in our sense, for ascending or traversing, if the rope over it is being 'played' by a human being. Then it may become an extra anchor or belay where natural belays may be lacking; it can secure a second man while he is looking after the leader's rope, and enable him to protect the party below against the consequences of the fall of the leader above. The occasions are so rare when a little ingenuity cannot find or contrive a better stance and anchor out of the natural features than out of a driven peg, that pegs are seldom worth taking on this chance, except for some known difficulty.

Any man who feels when he looks at a passage that he wants more protection behind him than the character of the rock allows his second man to give him, should not attempt the passage at all. If he decides to take the risk, he should do so only on his own account, and unrope from his party. He can send the rope down afterwards, or, in the case of a traverse, leave them one loose end to hold. As a protection to the party it is even better to unrope than to drive in pegs to carry the lengthening rope; and as a protection to more than the *morale* of the leader the peg is futile on such passages.

The times when it is justifiable to use pegs on a descent are the same as I have already mentioned in dealing with rope doubles: the intentional descent of that which has not or cannot be ascended, the retreats in worse conditions, or over glazed rock, and the races against time. The first is a praiseworthy exercise in gymnastics, for which rings, bars and poles may be taken and used according to taste; the last two allow of pegs or any other precautionary means we may have with us being used that may prevent defeat or miscalculation from becoming disaster.

I can imagine no other cases where a climber should not feel that he is confessing to incapacity or some misjudgment if he has to fall back upon pegs and aids

to help him to come down what he, or some other man, has ascended. After one such experience, any conscientious climber would now set himself to practise climbing down, until he had remedied a very serious defect in his qualification to rank as a good mountaineer.

So long as a man depends upon his own hands and feet and his knowledge of the rock, he remains master of the situation. He has four chances always in his favour. Whereas, if he is swinging loose from an inserted artificial peg, he has only one chance; and that one neither so much under his physical control as his own fingers and toes, nor even as calculable in its efficiency as a natural rock-borne belay.

THE AXE ON ROCKS

The axe is only less useful on rocks than on ice and snow. It is at once a long third leg and a third claw hand of honourable service. Its correct carriage in walking is important, and must become instinctive. Guides carry it, and it is the best position, over the hollow of the elbow, like a gun, with the head under the shoulder, and so turned that the curve of the pick adheres upward along the shoulder-blade and only the balanced weight of the shaft rests across the forearm. The only absolute rule is that, whether carried in hand or over or under the shoulder, the axe should always be held with the spike end of the shaft pointing forward. Nothing betrays the beginner or the badly instructed climber so fatally as an axe swung with the head to the front and the spike out behind. Habit should be trained so as to avoid this false position as instinctively as that of carrying a gun with the muzzle pointing directly to the rear.

Its Carriage.

Much walking, and all climbing, in the Alps is done in single file. Even the chance that one of the file may in carelessness swing up his axe into the wrong position, on path or easy ridge, is a perpetual threat to the eyes and teeth of anyone following him, and its possibility, in the person of one ill-trained companion, is an irritation for the whole party to contemplate. It is one of the slight jeopardies to harmony which a leader is justified in directly correcting.

It is best for actual climbing on easy rocks to carry the axe on a wide, soft sling on the wrist. If then both hands are needed for holds, it can be safely dropped for the moment on to the sling, and jerked back again, cup-and-ball fashion, into the hand, without interruption or the waste of even an arm movement.

If a steeper, and short, passage occurs where the arm must be entirely free, and the axe on the wrist-sling would hamper movement, the sling can be thrust right up on to the shoulder. The axe then hangs behind the

body and well out of the way of both arm and leg motions.

On rocks, whenever and wherever practicable, the axe should be carried in the hand. The machinations of an axe under control can be allowed for; but an axe swinging free from wrist, shoulder or back is a devil of stumbling and catching unchained. For this reason, the device, employed by most guides on long difficult passages or chimneys where the hands and shoulders must be kept free, of wearing a string loop attached to sack or rope, through which they pass the axe, is not sound. The axe is out of sight, loose and out of control. It is better to shove it through the loop of rope round the waist, where it is kept fairly rigid and its position can be allowed for. With a single movement it can be pulled to either side or behind, as convenience dictates.

It is useful to practise carrying the axe on British rock climbs, in order to acquire the instinct of its proper carriage for later indispensable service in the Alps. The alpine climber is never without his axe; and when he looks ahead at a rock section to select his holds, he subconsciously decides at the same time how he must carry his axe; in the left or the right hand, according as to which will be the outer or free hand; on the wrist, if it be only for a step or two; slung on his shoulder, for a longer passage; or thrust through his waist-rope on the left, right or behind, for a chimney or severe struggle.

If the rock problem is of great severity or length, it saves time in the end to tie all the axes on to a rope, and to send them up separately. So sent, they should be tied with a clove-hitch, not at the end of the rope, but so as to leave sufficient rope hanging below to guide them and prevent their catching. This also applies to sending up the sacks.

An axe of some ingenuity has lately been designed for use by a leader on difficult rock. This will take in half. On severe passages both halves can be packed into the sack for the time; or if the crack contains ice in places where there is no room to manipulate a long axe, the head half can be retained in the hand or in the waist-noose, and be conveniently used to make nicks in the ice or to serve as a claw-hand in minute cracks. It has stood some severe testing, but time has still to show if the convenience of the shortening is secured at

too great a sacrifice of strength in the shaft to make the axe sound for long or heavy step-cutting.

The short axes popular with those modern climbers who rely exclusively upon their ice-claws, have a habit in rock climbing of working out of the waist-noose or sling and disappearing down the cliff at crucial moments. They are also of no use as the invaluable third leg on easy rock or in descending.

When halts are made it is important to see that the axes are put in safety, where they cannot be dislodged by forgetful movements. A climber without his axe is like a lion-hunter without his rifle—and no tree to climb.

As an Extra Hand.

In ascending rocks the axe comes into use as a long claw-hand, where snow, ice, grass or heather covers the ledges and hides the holds. The pick can then either be driven in as a handhold—in which case it is important to remember that the axe must be held rigid in the position in which it is first driven in, whatever the subsequent alterations in the direction of the pull upon it—or it can be used to clear out the obstruction.

On bare rock, if the pick is driven into a crack and the shaft set firm against the rock below, the head can provide a useful handhold or foothold; it can be further secured if it is held in this position by a man below. As a pull handhold, with the pick hooked over an edge, in ascending rocks, it should be used with caution. The direction of the pull upon a handhold always tends to change, as the weight is raised near or past it; and an axehold can rarely be found of a kind to resist the outward or slanting strain as a climber raises himself. One or two guides in the Alps have perfected a remarkable trick that may be mentioned. When a vertical or sloping crack in a slab gets too small even to admit a finger, and all other holds are lacking, they force the point of the pick into the crack above their heads, and give a slight outward and upward twist to the shaft with the wrist, so that the point of the pick and its square edges are jammed slantwise and upwards in the crack. Holding the shaft rigid in this position, they then raise their weight by sheer strength inside the bent arm which holds the shaft, at the same time using whatever friction-holds they can find for their feet to help them. A second's catlike clinging of the feet and of their free

hand to the rock gives them just time to thrust the pick farther up the crack and twist it firmly in again. The feat is one that demands exceptional strength and skill, and it is only employed in circumstances from which the best amateur would retire without choice. But it is worth practising, if only to be held in reserve as a relief or extra security, when, on rocks less naturally desperate, a crack or a slab proves unexpectedly iced or nasty.

I have occasionally seen an axe-head made use of in the fashion of a 'peg.' Where a belay point was lacking, a climber has jammed his axe-pick in a crack, and anchored or belayed the rope over it. I never came upon such a contrivance without a distinct feeling of relief that, in once again avoiding 'coming upon the rope,' I had once again shirked being the first to make trial of the doubtful efficacy of this sort of belay.

In well-chosen spots, the familiar ledges or terraces where slopes of deep heather or grass cover the rock and leave no sure stance, the axe can also be used for belaying. The spike should then be driven in deeply, the shaft sloping away from the pull, and the rope be passed low down round its base, getting some extra friction upon the grass or heather immediately round the shaft. But these belays should be employed with discretion.

As a Manx Leg.

In traversing the crests of long ridges, with their constant rise and fall, and in descending easy or moderate rocks, the axe, well handled, is an invaluable telescopic third leg. The spike of the shaft reached forward or downward to some cranny or lower step beyond the reach of the foot, preserves the balance in free walking or during a long downward step. Its practised use enables the body to balance continuously and rhythmically in a walking upright attitude over broken crests or down angles and high steps of rock that would otherwise demand a constant effort of balance and much help from handholds.

Even in the hands of a beginner it prevents him from crawling where he should be learning to walk in the rhythm of balance. In so far as it makes for upright movement it is the first instructor in balance climbing on easy ridges and descents.

In descending sideways to the rock, the axe-head, short held on the ledges, can give relief to the continued drag on the hands. Or again, if either hand is occupied with the rope, the spike of the axe thrust down to a lower edge with the free hand gives balance for the next awkward descending step, and avoids the check to the rope that the search for handhold, and the turn of the body to use it, would produce.

In traversing or descending easy faces or ridges, the axe, held straight across the body with the spike towards the rock, can give just those touches which the balance in easy movement from time to time demands, especially when there is loose rubble on the passing footholds or their angle slopes inconveniently.

In dancing down or across loose scree or moraine, that last test of rhythmical leg movement, which becomes a step-dance of delight or a slow, unhappy crawl according as it is rightly or wrongly performed, the axe held in the same position makes at any moment, with a passing touch, a third leg for balance. But it is wrong and retarding to make a perpetual tripod with it, and to lose the rhythm of balanced movement by continually leaning upon it.

CHAPTER V

CLIMBING IN COMBINATION

IN no craft or sport is combination so vital as in climbing. The brilliant individual run or single score is impossible. The members of a party are combined for life or death. Their achievement is that of their united efficiency. Their progress depends upon their success in realizing complete harmony of thought and movement. The rope is their nervous link. There are few things more pleasing to watch than the co-operation of a good rope on a stiff rock climb. To the untutored eye the party may all appear to be doing different things—some pausing, some turning, some climbing. Only the expert may discover the continuity of motion passing from one end to the other of the rope through the separate actions of each climber. Like the progress of a snake, seen in a slow cinema film, the sinuous connection is only apparent to the eye that can read in each apparently stationary phase its relation to the phase which precedes and follows it.

Collective Rhythm.

To climb as an individual, each man has to learn how he can most safely and economically manage his muscles, his will and his nerves, and how to accommodate his personal rhythm to the accidents of rock structure. To climb in a party, he has to adjust this to the collective rhythm of whatever men he climbs with. He has not only to get up rocks, he has to do so as part of a machine. If all the party is moving together, he has to watch the hands and feet of the man in front, so as to lose no time in renewed searching for his own holds; to see that the rope in front does not catch or lie about, but take it up in loose, neat coils in his hand, and let it out again as required; to keep his distances, so as not to hurry or jerk the men in front or behind him; to carry his axe and generally

a loose coil of rope; and at the same time to climb securely himself, with a view to having to meet at any moment an unexpected slip by some one else. If the party is moving singly, he has to see exactly where the man in front goes; to watch his position on the next stance above, so as to adopt at once the right attitude for belaying or holding the man below when he himself reaches the stance in his turn, and to pull in the rope of the man behind as he comes up, while seeing that the rope of the man in front runs out without hitch.

Climbing on the rope falls naturally into two divisions of technique, alternating in their employment according to the difficulty of the rock traversed and the ability of the party: that of all moving together, or 'continuous climbing,' on easy and moderately difficult rock; and that of moving singly, 'interrupted' or 'one at a time,' on difficult rock; in the latter case the man above will always be stationary and 'anchoring' the rope for the succeeding climber. This distinction is made throughout in discussing the different uses of the rope.

The mastery of continuous movement on the rope is the more important; it is the finer art, and the better foundation for big mountaineering. But it has become too much the fashion with our climbers to ignore its importance, and to treat, and therefore to train their following to treat, each section of rock as an individual 'problem.'

The necessity of learning how to move singly is forced upon us in any case by the sectional character of most of our difficult British rock climbs, which are apt to divide themselves into separate 'pitches.' Unfortunately, the effect has gone deeper. Not only do we practise moving singly almost to the exclusion of collective continuous climbing, but we allow the interrupted method to destroy the rhythm and pace that properly form part of good 'one-at-a-time' climbing. Such sectional climbing establishes a habit which is bad for the individual style and disastrous in big mountaineering.

A mountaineer on a rope has to learn to feel that he is charged with a portion of a united personality represented by the rope. In proportion as he himself is secure or not, at any moment when others are less well placed, he carries a greater or lesser share of this collective responsibility. If all are moving together, his own

movements are of importance to the party in so far as they coincide with the collective rhythm and contribute to the pool of safety against accidents. If the party is moving singly, at the moments when he himself is actually climbing he is free to look after himself alone, but the instant he has ceased to move he has a double measure of security to assure for those starting to move above or below him. This is his contribution to the combined safety of the party. His contribution to the collective pace is that he should climb as quickly as is consistent with safe progress and not as slowly as his own comfort might desire.

Slack habits on short English climbs prevent a party ever finding its rhythm, or even discovering its value as a combination. A good party acquires a fine collective momentum from the impulse transmitted by the sharp ending of one climber's effort to the immediate start of the next man. There is as attainable a rhythm in 'interrupted' climbing as in continuous climbing. When a party can move singly or together, slow or fast, and yet retain its collective rhythm, it will have bridged the gap between the severe problem-climb that may have seemed to it the limit of individual performance, and the great alpine expedition which may pile fifty such problems into a day without coming to the end of the greater collective power of a roped party.

Imitation.

A climber's first task on a rope is to learn to watch the man in front. This must become a second nature. It should be sufficient that one man has found the right holds; it is a waste of time and a bad break of rhythm if all, or even one other man following, finds it necessary to look for them again. On continuous climbing, pace cannot be achieved without this subconscious imitation. On difficult 'one-at-a-time' climbing, to fail to start or to follow with the correct hand or foot often means failure to follow at all where another has easily led. There is nothing lowering in imitation. Big climbing is not competitive puzzle-work. The man behind is in any case handicapped by the rope, and by his extra share of responsibility in guarding his leader. He owes it to the party not to waste time in working out the leader's job for himself over again. This habit of observation may become quite unconscious. As a personal instance, I once traversed the Matterhorn with a

well-known guide as companion. In descending, I was occupied subconsciously in choosing holds and consciously in examining a prospected route on the distant Dent d'Hérens. We were unroped, and the guide was some distance in front. I have no recollection of noticing him. After a time I found myself constantly adjusting my line so as to take holds always with the same hand. I remarked the fact gradually, because I became conscious that it was not always the obvious or most convenient adjustment. In an instant the explanation flashed across me. The guide climbed admirably, but an accident some years before had left him only one hand to climb with. Unconsciously, or as a third mental operation, I had been noting his adjustments and imitating them without being even aware that I saw him.

A criticism very frequently made, especially of a man untrained in combined climbing, is: "You can't depend on him; he takes different holds:—I never feel sure with him on the rope behind." If the man moving in front knows what holds the next man is using he knows where he will be encountering a difficulty or a loose hold, and he is already half prepared in case of his help being needed. If, on the other hand, he knows only that a new set are being discovered, he has to be constantly turning round and waiting, and uncertainty is added to his necessary watchfulness. The criticism applies, primarily, to climbing on rock of a certain difficulty, where there will be only one 'best' line of holds to use. On easy rock greater liberty is permissible. At the same time a distinction must be drawn between the duty of noting the holds, and their fashion of use by the man in front, and the duty of using them in precisely similar fashion. On very difficult rock passages a man of different physique may, from lack of reach or a divergence in proportions, find it necessary to employ different adjustments. None the less will he profit by having noted the holds his front man used, and, in most cases, by imitating his actual fashion of using them. On such passages of course the party will be moving singly. The front man will therefore in any case be on his guard, and no extra risk or loss of time is involved in the enforced departure from his method.

If the party is moving one at a time, it is easier to

notice the exact holds taken by one's predecessor, but it is also easier in this case to forget them again in the excitement of watching his further progress. Therefore, in moving singly, the effort of noticing has to be more directly conscious.

If we are moving together, conscious observation is assisted, and in part supplied, by the continuous action of the body, as it adjusts its poise of its own accord not to one hold, but to a sequence of holds. If a man is swinging along to the same rhythm as his leader, his body automatically makes use of the same holds as the leader has found to suit his balancing progress.

But if we are moving one at a time, each man has to watch the holds. We have to notice not only what holds the leader tried and rejected,—as these will be the obviously convenient holds whose temptation must be resisted if his example is to be of service,—but what were the actual holds and movements by which he finally conquered. For the sake of those following it is important to imitate these as closely as we can. It is astonishing how many good climbers fail to notice even, say, such an important point as the fact that the leader turned round so as to face the opposite wall of a crack at a particular point ; and how many more can give no account of what holds they themselves used, even the moment afterwards. It is a sign of a poor mountaineer if he has to call out to his front man for guidance : " Did you go to the right here ? " or " What do I do now ? " It is generally impossible to direct him from above, however well the leader may remember the holds, especially if he is standing back, as he should be, in order to hold the rope. All the necessary guidance should have been noted during the front man's ascent.

Apart from acquiring this faculty of imitation, the climber has to learn how to manage the rope. It might be maintained that, on places where all the party are able to move together, the rope is not needed. But in big mountaineering the easy and the hard passages alternate so frequently that the constant taking off and on, the coiling and uncoiling of the rope, would involve great loss of time. There is also, even on easy rock, always the possibility of a slip or of a breaking hold to be considered, even

The Rope while Moving Together.

with a first-rate party. Often there may be danger when there is little or no difficulty. And since good men can hold almost anywhere, even while moving, if one of them does slip, the rope protects him against any worse consequences.

The Rope to the Man in Front.

In continuous climbing, with a good party, each man, unless he be the leader, is primarily concerned with the section of rope in front of him. It is best to keep this always a little slack, and to gather up one coil or two coils in the outside hand. These loops can either be retained while the hand is used for holding on, or they can be dropped for the second if the full grip of both hands is needed. But your first concern is not to jerk the man in front; it is only of minor importance to get up comfortably yourself. For the jerk on your friend will be unexpected, and therefore disturbing, if not upsetting; whereas inconvenient holds for yourself, or the extra effort required to keep the rope clear, you can foresee, and therefore discount. To break your own rhythm under these circumstances, in order to avoid breaking that of the man in front, does less injury to the collective movement. It is often better, for the same end, to take an awkward touch-hold, with elbow or knee, rather than to lose time in dropping the coils so as to free your hand. If the coils have to be dropped, the time can yet be saved and the rhythm remain unbroken, if you quicken up for a step or two and close in on the man in front. The loose coil in the hand of the man behind you will leave you this margin. When you drop your coil, see that it falls into a position in which it will not be likely to hitch and from which it can be caught up again at once.

The arm, with the hand, has above all things to learn the mechanical swing which frees, frees, frees the rope in front of you, before, after, and even during each step, at whatever inconvenience to yourself. It is something of the motion of cracking a whip slowly, upwards or sideways according to the lie of the rock. The art of the swing, from all positions, can only come with practice.

Fortunately for us, the business of watching the rope combines conveniently with that of watching the movements and holds of the man ahead, and does not with-

draw our eye from its first duty. Meanwhile, for our own holds we must trust to the hastiest of passing glances, and depend for the rest on our imitation of our front man. To this extent combined climbing makes a further demand upon the ability to take holds previously marked, unaided at the moment by sight; an art which the feet and hands have had to learn in acquiring balance method.

The Rope from the Man Behind.

With the man behind, in continuous climbing, we are less concerned. If he is of equal strength, he can be left to himself. Yet we have to remember where the checks of difficulty or bad holds occurred that broke our own rhythm, and we must allow for them in turn by slackening our pace slightly when instinct tells us that the man following is approaching these check-points. If a party is moving well in tune, we shall know without looking round when the next man will probably be checking or when he will be forced to drop his coils of rope for better hold. We shall therefore be prepared for a check, or even a jerk to our rope should a blunder occur. If the man behind is distinctly less expert, some allowance in pace and attention has to be made at such times; and it is as well, without necessarily stopping or turning round, to feel backwards with one hand, and discover if the rope is advancing freely. The hand can even take up a coil or so of the rope behind, and hold it together with the coils it holds of the rope in front. We then have some margin of rope to let go in case it is checked from behind on such expected places. A weaker man behind may be expected to check where his predecessor passed without pause; and to take up a loop or so of his rope, bringing it taut in the act, keeps us in touch with his movements, and ready to help him if needed, without forcing us to take our eyes off our leader or our attention off our own progress. If the man behind is a novice, it is best always to adopt this plan, and leave him free to use his hands, while we ourselves hold the loose coils which normally would be his care. This throws a double task on the middle man, who thus has two ropes to manage; but a good centre will be able to keep all his eyes for his leader and yet discern all he needs to know about the progress of his rear man from the feel of the rope.

In steep climbing, where the party moves one at a time, the rope is used for direct protection and not merely as a precautionary link. The rope is for safety; it is not for assistance. Above all, there is no magic in its use. It does not or cannot level up the powers of an unequal party to the standard of its best members. In so far as members of a rope find it necessary to have recourse to it as direct aid, they are drawing upon the reserve of strength and security which the party pools, and thus diminishing the margin which is required for their feats in the lead by the more expert members. They are depriving the party of its rhythm, and the leader of the sense of a safe collective capacity behind him, which is the impetus that makes for his success. This warning is not unneeded at the present time. It has become the custom for a group of first-class leaders to conduct various assortments of less capable climbers up the most difficult climbs in our islands. For them it is only a friendly effort. The climbs are short; the reserve of a good leader is sufficient for such 'one-man' climbs, which are climbed 'one at a time.' But the harm for the individuals who follow may be great. They are depriving themselves of any chance to develop their own balance and confidence. They are confusing their judgment as to their own unaided capacity, and are spoiling their taste by sensations they cannot digest. They may be getting into careless habits of trusting to the rope as an auxiliary engine whenever their wind or power fails. When these methods and ill-assorted companionships are transferred to the Alps, the results are lamentable. With difficulties magnified a hundredfold in length, upon climbs which can only be expected to yield in a whole day to the attack of combined efficiency, and with far longer hours of easy climbing to face, of a kind to demand the utmost individual precision for its timely passage, such methods make impossible demands upon the margin of power and security that the ablest of leaders has over for the common 'pool' of his party. There follow late returns, and exhaustion, and ill-temper, and nights out, if no worse. In this respect British climbing may be the very reverse of a preparation for the Alps. The rope can be abused until it becomes a danger.

The Rope while Moving Singly.

There is no harm in taking an occasional pull from the man above; some rock passages are more difficult for certain types of figure, others for others. The hour and the weather may on occasion make it better not to waste the time of the party. But any man who has habitually to give 'trunk-calls' is climbing with a leader and on a class of climb beyond his capacity. He is delaying the party and injuring his own climbing permanently. If it is only practice he lacks, he should insist upon better opportunity for real practice and a slower pace. If this does not relieve him from the necessity of 'rope-riding,' he will do himself more good by working for a period on easier rock with a humbler rope. If, on the other hand, he finds that as his technique improves he can manage unaided all that his leader sets him, he should insist on being given his share of leading.

Following and Leading.

This will be the more necessary if he begins to find himself in doubt whether he could lead places over which he knows he can follow capably. He has clearly then been neglecting a most important side of his climbing education, his self-knowledge and confidence. It is a fact that any moderate climber who has not sacrificed his own sound training and the education of his nerve to the exactions of too rapid a party, climbs twenty per cent better, when he is leading, than he ever does when he is following. There have been plenty of cases of men who for years remained average climbers behind some dominating leader, and who, when placed by some chance reluctantly in the lead, suddenly developed powers beyond all expectation, and retained them. They had merely to add self-knowledge and confidence to their technically thorough training.

Conversely, it is a fact that a man who has been accustomed only to lead climbs some twenty per cent worse when he has on occasion to follow. The habit of imitation, the instinct for rope management, and the necessity of taking and not setting the rhythm are all novel to him. To this defect in education is in part due the disappointing performances of some excellent rock climbers when they first mountaineer in the Alps. Men always accustomed to lead at home never climb at their best behind a guide. And men who

have always followed have never acquired confidence or self-dependence sufficient to meet new circumstances happily. For these reasons every habitual leader should accustom himself to follow at home ; he will be far more efficient when he starts to learn his business behind professionals in the Alps, or when, with a guideless party, he has to alter the order, and follow himself, as is sometimes necessary for greater safety. Again, every one upon whom circumstances force the position of generally following, either on British rocks or in the Alps, should insist upon his share of leading where he feels that it is within his physical powers.

Stances.

The extent to which the rope is now used as a general assistance or as a decoration on easy passages is apt to contribute to a neglect of the study of positions proper to its secure use in places where its protection is really needed. It is as vital for a leader to know what character of stance he requires in order to bring up his following safely, as to get up a passage himself. Many old climbers are frankly inept in their choice of stance and of attitude upon it. It would seem simple enough for a man to think out from what direction a pull will come upon him, and how he can best place his body to meet it. But many minds can never get beyond the sense of a comfortable attitude of body at the moment, and quail before the further step of considering how that attitude is suited to a pull from a particular direction. It brings a shudder to remember occasions when we have arrived at a platform after a severe struggle and found our anchor man carefully jammed in a position that could not have resisted the faintest pull from the only important direction ! And behind the possible doubt in many a man's mind, so placed, seems always to be the dangerous feeling : " Anyhow, it's only for a moment, and old So-and-so won't slip." Perhaps So-and-so half-way up calls out, " Can you give me a little pull ? " For So-and-so has been climbing probably with something of the same sort of feeling : " I'll have a shot ; and anyhow, there's always old Such-and-such up there with the rope ! " At the call comes further doubt above, and even that ominous " Wait a second ! " while the upper man hastily tries to alter his position. This is as common an event as it is unpardonable.

The ' Wait a second ' man may be a perilous goose ;

but even he is not so bad as the 'All right! come along!' man in like situation. A leader—and I am not writing without knowing of instances—who under any circumstances of excitement or difficulty says he is all right to hold when he knows or even suspects that he is not, and who allows his next man to enter on a doubtful passage on this false understanding, is guilty of constructive manslaughter, only partially redeemed by the possibility that it may be also constructive suicide.

A climber has to think out exactly how the pull on the rope will come, and what hold he has about him to help him to meet it. Our object is to stay in balance on the feet as long as possible, so as to be able to pivot on our legs and meet the strains, if and as they come. To sit down is an all too vulgar error. On steep sloping ledges where we stay the heels against rock or herbage, or astride of a ridge, or jammed in a crack or chimney, we may have to sit down; but our position is weak. We are out of balance and out of the true line of the rope, which almost of necessity will be fraying over some edge, interrupting our information as to how the invisible man below us is getting on, and not improbably loosening stones on to him.

Whenever the stance permits we stand in free balance on the feet, with our outside or firm leg in line with the pull of the moving rope. The body inclines inward, ready to take the pull, if it comes, down the thrust of our rigid leg. If the ledge is narrow, we rest against the rock with shoulder or our inside knee, but still keep a free poise of the body to meet any slight alterations in the direction of strain. If the ledge is too narrow to allow us to lean back and so take the strain down through our leg to the rock, or if the stance does not even allow of balancing without handholds, then we must look out for a belay or anchor, any knob or split corner of rock, round which to pass the rope as extra security.

With Belays.

We make the distinction between an 'anchor,' the loop of inactive rope with which a stationary climber secures himself to a rock point, in order to protect himself and the rest of the party while somebody else is climbing, and a 'belay,' which is the rock-and-rope attachment by which the active rope of a moving man is protected while it is running out or being pulled in.

We distinguish again between a 'direct belay,' where the rope in action connects directly on to or round rock, and an 'indirect belay,' where some form of human spring is interposed between the active rope and the solid rock.

The *anchor* should not be made with a section of the rope momentarily in action. The man on the stance takes a loop of the inactive rope between himself and the next stationary climber and puts it over a point. He can either hold it there looped, or secure it by putting on a second coil, which will confirm it by friction. An anchor is not much good unless it is quite close to or vertically above us. The farther off it is, the more open it becomes to all our objections to a direct belay. Its object is to assure the balance of a stationary climber while he is managing the rope of a moving climber, and safeguard the rest of the party in case of the fall of both. The same point of rock may have to serve for both anchor and belay, but their affixing should be quite independent. If a leader, wearing necessarily only the one rope, the active rope to his second man, wishes to secure an anchor, he must divide his anchor loop from that portion of his active rope which he is using to belay his second man by very secure friction coils round the rock. If there is no place for both anchor and belay, the anchor must be sacrificed, and the belay then made as indirect as ingenuity can devise.

The *direct belay* is unsound to protect a *leader*. If the rope is playing round rock, it may at any second jerk him, a fatal fault. If he falls with a long rope out, the rope will, or ought to, break, when the jerk comes directly upon a solid point, and very often a point with sharp edges. If he falls on a short rope, similarly attached directly to rock, the chance of its snapping is only slightly less. For a long rope may take up much jerk in its elastic spring, but a short rope cannot. This should be more widely known. Many leaders think they will be safe in trying a risky passage if they can find a direct belaying-point which only leaves a short run-out. They either use it like a 'peg,' passing the rope behind it and taking out enough slack to let them do the passage, or they bring up their second men on to bad stances to hold the rope over it. Neither course lessens the risks of the direct belay. Some prevent-

able accidents have been due to this dangerous misconception.

An exception would appear to be the case of the leader 'threading the rope,' behind a jammed stone, in order to protect himself in attempting a bad bit from a stance not good enough for him to bring his second up to. This 'threading' is only sound if, firstly, the run-out above it is only to be for a few feet; and, secondly, if the rope will *run* freely behind the stone so that the second man below can play it and turn it into an *indirect* belay, to some extent, in case of a slip. Otherwise threading is really only a brittle reed of moral reassurance for a leader who is uncertain about his standard of the day.

As a protection to a man *following* us up rock the direct belay is almost equally unsound. To drag the moving rope round rock frays it, and runs the risk of there being a hitch or some slack rope to complicate matters if he slips or needs a pull. Few knobs can be trusted to retain a travelling rope unless the hands keep it in position. A rope dragged round a point, also, rolls against the lay of the strands, and may roll up and off a rounded knob unexpectedly. Again, a rope may play easily round a splinter while it is loose, but when a strain comes upon it it will jam in the crack behind, and the sudden stopping of the 'give' in the rope pinches and may snap it. In one-at-a-time climbing it should rarely be necessary to take a direct belay to protect a man following. It is our business not to use a stance unless we can render its belay in some way indirect. Only in continuous climbing do we content ourselves sometimes with cursory direct belays, generally in descending. Then they are simply a passing precaution, not a definite protection; and they are sound because the easy character of the climbing will permit us, at need, instantly to convert them into indirect belays or anchors. Otherwise direct belays are more often used in laziness or ignorance than from any dire climbing necessity.

For the *indirect belay* we loop the active rope of the man climbing round a convenient point, and then make it our business to interpose our hands, arms, legs, shoulders, or any part of us which may prevent a jerk of his rope from coming uninterruptedly on to the solid rock. If we have fair room to balance, we play the rope

entirely free with our arms and the spring of our body, using only an anchor to the rock if we need it. If we have not room, and especially if we are protecting a leader, whose fall would jerk us off most positions of free balance, we put the rope over the point and play it round with both hands, ready to grip and spring it upon our arms if a jerk comes. Or we pass the active rope round our forearm or over the thigh or across the shoulder, on its way to the belay-point.

It often happens that the rope does not play easily round the belay as we pass it from one hand to the other. We may have to free it and run a coil through quickly, or alter its lie round the belay. These shifts should never be made except when the man protected by the rope is momentarily at rest. Similarly we may have to take it off the belay for a second, to let it run out quickly enough for a rapid leader, who above all things must not be jerked. For these adjustments it is better to keep always a small margin of slack in the rope, which we continue to take up in the hands as they play the rope round the belay, until a suitable moment comes for making the readjustment we intend. This margin also leaves us a loose curl through which to twist wrist or arm, as an extra spring, in case of a fall on the rope.

As an extra precaution we may insert glove or cap or even earth between the rope and the knob, if we think it may reduce the friction or ease the passage.

We may not always be satisfied that we have rendered our belay classically indirect, but we can always prevent its being crudely direct. Our eye must learn to take instinctive offence at the sight of any active rope running direct from a moving man to a rigid rock.

Belays and handholds are almost synonymous, for there is very little handhold which ingenuity cannot convert into some form of extra security for the rope. Where handholds fail us, belays fail us, and we have to fall back for our securing of the rope upon balance and the mechanics of our bodies. The nature of the stance suggests the position. The strongest holding attitude is that of the body turned somewhat sideways to the direction of the expected pull, and inclined slightly inwards over the inner bent leg; thus the strain is taken down the outer rigid leg to the rock. This leg is planted firmly on the foot,

Without Belays.

and sloped in the same line as the rope from the man ascending below us, or, alternatively, in the line which the rope from the man above us may be expected to take, supposing he were to fall. The sideways turn enables us to make a spring of the body; which we bend or straighten over the bent inner leg and behind our rigid leg, as we pull in or check the rope, without risk of being pulled off our stance. Whereas, if we face squarely outward, we cannot get *behind* both our legs, to pull, without sitting down; and any forward bend of the body, to meet a pull, risks the balance and the foothold.

We use any roughness of the surface as extra purchase for the outer, firm foot. Two such small holds, if only for the side-nails of the boots, give sufficient purchase, under a body in balance, to lift the whole weight of a heavy companion, or, less certainly, to check a considerable weight falling from above.

Sometimes it is best to bend the inner leg until the knee rests against the wall behind. If the rock above us projects, or is so steep that we cannot lean in behind our firm leg, the stance is not sound without some belay. But it is at times possible, if the stance is broad and the slope of the projection above allows it, to kneel on the inside knee, and belay the rope over the outside knee with both hands. A man with powerful legs can make this a secure spring for the rope. The centre of gravity is so low in this position that a heavy jerk from below can safely be taken. But it is useless, of course, without other hold, as a belay against a fall from above.

No stance is sound without a belay or anchor where we feel we need handhold for our balance, or where we feel we shall need it to resist the pull of a rope, from below or above as the case may be. No man, dependent upon handhold himself, is safe enough to secure the rope for another climber. He must either be able to convert his handhold into an anchor for himself or into some form of indirect belay for the climber, or else he must seek another stance.

The more we learn of the mechanics of climbing, the more we incline to use only *free stances* if we wish to assist or protect a man *below*; and free stances reinforced by *anchors* on the inactive rope to protect a leader *above*; and the less and less we get to like even indirect belays, for either, on the active rope. For a man below,

it is of more assistance that we should be able to give him the immediate pull or steady with his active rope which a free stance or body belay allows us to do, and which will prevent him slipping at all, than that, when for lack of this instantaneous touch he has slipped, his active rope should be rock-belayed, and should be thus more stonily certain of stopping him in his further fall. For a leader above us, it is of more service that we should associate ourselves with his action, keep a free stance or a body or arm belay on his active rope, and, if he falls, be free to interpose all our human mechanism to ease the jar, than that we should seek to diminish our responsibility and risk, and increase his danger, by entrusting his active rope to the perilous rigidity of a rock belay We must, indeed, always take an anchor for a leader on the inactive rope, if we can; because this strengthens our position in functioning as his human spring, and protects the rest of the party in case of our failure to save him by our interposition. And we should take it for a man below, on severe rock, whenever our free stance is not secure enough to safeguard ourselves and, consequently, those above us.

But the very human inclination which assails our novitiate upon all rock that tries our strength or imposes upon our nerves, to shove off our responsibility on to any rock point that presents itself, and to jam the active rope round it, regardless as to whether our position will allow us to interpose any effective human spring upon it in case of a slip, below or above us, must be sternly resisted and unlearned. Unless we can be certain that we can keep the belay an indirect one *when the pull comes upon the rope*, and not only while we are daintily handling its slack, we must not take the belay. If we cannot substitute for it a free stance or an anchor on the inactive rope, we must reject such a stance altogether, and move to another.

In my experience, the better the mountaineer, the more boldly he throws in his lot with the action and security of the man at the moment climbing above or below him; that is, the more he associates his human mechanism, either as impulse or as check, directly with the active rope; and uses the rock, for anchor or indirect belay, as a protection behind him for the inactive rope and the rest of the party. Between good climbers the

rope serves as a telegraph wire. So long as it runs free we can receive our call for help or reassurance and return our instantaneous touch or impulse down it with a response that is almost anticipation. Any rock interposition interrupts the one and delays the other. The rescue of rock should be held in ready reserve, to reinforce us with an anchor or with an indirect belay, after our human spring has performed its function and has at least absorbed most of the stock.

Holding the Rope.

Climbing rope is as a rule too thin to be conveniently held or pulled with a heavy weight at the end, except by men of abnormal grip or specially developed hands. Many men, therefore, when taking position for holding on a stance, anchored or not, give the rope one or two half-twists round the forearm. This is convenient, but not without risk.

The most comfortable position, on a free or anchored stance, is to pass the rope round the body just above the hips, gripping it on either side in front with the two hands, and passing it along from one to the other hand as required. The best hand-grip is to turn the palms of the hands upward, and to lay the rope between the first fingers and thumbs of each hand. If the outside arm is then turned slightly outward, palm up, and the body, as it stands sideways to the pull of the rope, is inclined inwards, thrusting against the outer firm foot, the body, the outer firm leg and the outer arm will all be approximately in line with the direction of the pull. The utmost use is thus being made of the spring-pulley of arm and body, with no energy wasted round corners. The inside hand pulls in or lets out the rope round the body. The spring, up or down, of the body from the waist is ready at any moment to help in absorbing the jerk of a pull from above, or in giving the steady 'little pull' that prevents the jerk coming at all from the approaching man below. The rope passing round the body and the forearm gives a surprising amount of resistance in friction; more so, owing to the elastic surface it embraces, than is given by a rigid belay. With its aid, if the feet are firm and the balance good, we can take a man's weight on one arm alone, and leave the other hand free to hold the loop-anchor, or pass the loose coils round the belay or round our body as they come in. Naturally we can resist a far greater strain

on the rope round our hips, and immediately above and behind our firm leg, than our balance could support if the pull came higher, upon our arms and shoulders. It is sounder for this reason, when we use the body belay, always to pass the rope round both hips and out under the arm, and not bring it out, as is usually done, over our inside shoulder. The pull is sometimes, but not often, vertical enough to make this last a sound position. The same rule applies even more strongly if we are forced to stand facing outward.

Sometimes, when there is no room to balance for the body belay, and we find no rock belay or anchor low enough to allow of our using our arms as effective springs on the rope, we have to be content with high handholds or an anchor-point well above us. In such a case we can often interpose our shoulder as a spring. While we hold the anchor on the point above us with the one hand, with the other we pull a foot or so of the active rope down across our inner shoulder and upstretched arm, springing the rope, as it were, across the bow of arm and shoulder. We thus convert the high anchor into an indirect belay.

A very common position upon steep rock, where our stance is too narrow to allow of turning sideways or of belaying the rope round the body balanced above the firm outer leg, is to turn face inward, and pass the rope round some belay-point from one hand to the other. The only way to make this sound, that is, to prevent the rope in case of a slip coming upon the rock as upon a direct belay—since the grip of one hand on the active rope must be insufficient to act as an effective spring,—is to give the rope one twist round the forearm of the hand behind the belay. With the rope half twisted round the free hand, which is drawing the rope out in front of the belay, we can apply, as between the tug of the arm behind and the 'give' of the hand in front, an efficient spring. With such a hold we must wait for the pauses of the man climbing to pull in the rope round our belay. To pull it in while he is actually climbing deprives us of any chance of applying the hand-spring in time.

I have noticed, in confirmation of what I have said before, that the more freely balanced and adroit a climber becomes, the less often he appears to find it

necessary to use this sort of quasi-sound stance. On the same ledge where the average man would turn face inward for his rock belay, the expert will find some good leg-thrust for a sideways body belay, and will use the rock point for an anchor-loop to protect a man above, or often only as an extra balance hold for his inside hand if he has to resist a pull from a man below.

The Order on the Rope.

To get the order on the rope right is as important a duty as to get men in their right places on the battle-field or the polo-ground. Every man should take his share of leading on suitable rock if he is ever to improve or discover himself; but on difficult or unsound rock, or on new climbs, the best climber should always lead and come down last. Tossing for the lead is folly. On easier rock, if the order is not dictated by capacity or by fair alternations, climbing is too gracious a sport for its precedence to be settled by chuck-penny rather than by courtesy The accepted manager, in cases of doubt, must decide. A mountaineer who either from amiability or from incapacity to gauge a climb and his friend's power allows a less expert climber to lead or descend last on a climb which he knows or suspects would test his own strength, is gravely at fault. Some men, however, seem incapable of remembering how much effort a climb cost them. They have done an exposed climb themselves. With the pride that apes humility they let some enthusiast, their inferior, have his way and lead it the next time, confident in their own skill, or the fallacious doctrine of the belay, to find a remedy in the last resort. But difficult climbs are full of passages where the second man cannot really protect his leader or last man. The leader falls, and the rope, if it does not break, only serves to support an injured or nervously shaken man. Whether the results are serious or slight, the error is equally great, and the expert of the party is to blame.

The Order on Direct Ascents and Descents.

In parties of equal merit, of any number, the order is unimportant, except that, as stated, on difficult passages, up or down, the most experienced leads up and comes down last.

In efficient parties of four, or of any even number, on easy and moderate rock, it is best to rope in parties of two, ascending or descending.

In parties of three of unequal merit, the weakest

man goes up last and comes down first,—with two exceptions of which I speak later under the Order with Beginners.

In parties of four of unequal merit, on easy and moderate ascents, where the leader is good enough to require no special protection, we may distribute the skill, and put a weak man behind the leader, the second best man third, and the weakest man at the end. The leader and the second string can then each look after one tiro. This is especially advisable on ascents or descents where the rocks allow of all moving together. The accidental slip of each weaker brother can be quickly corrected if he climbs below a good man; whereas, if the two weak men are put at the tail, the slip becomes cumulatively perilous to the party.

On really easy ascents and descents with a party of this size and character, the alternative is admissible of breaking into parties of two, each of the two more expert taking one of the weaker men on his rope.

On ascents of a medium class, where movement may, however, have incidentally to be one at a time, the order of the tail in a party of this constitution is less important. On harder sections the watchful eye of a stationary man above will always be on the motions of each climber in turn, and a slip can be checked at once. But if the novices have not even mastered the art of holding from a stance, two ought not to be placed next to one another, even for this moving one at a time. But strong men, even as novices, will always be able to learn the art of stance-taking before that of continuous moving.

On really difficult rock, or on new ascents or descents, the leader must always be backed up and secured by the next best climber of the party. On such climbs as many as two weaker men should never be taken in a party of four. Behind two good men one novice may justifiably be trailed at the end of the rope.

Parties of five or more, which are cumbrous for stiff climbs, can take novices, in the proportion of two to five or three to six, if they feel so disposed.

On climbs where long traverses are anticipated, either along ridges of moderate difficulty or diagonally up or down faces, the best man still goes up first and comes down last.

In a party of fairly equal strength, the second best

should still come next to the leader, if it is anticipated that the major part of the climb will be upward or downward and not on horizontal traverses.

The Order for Traversing on Faces and Ridges.

On difficult diagonal traverses, upward or downward, it is still of first importance that the leader or last man should be well secured.

With the same party on horizontal traverses the same order should be followed.

But if one member of a party of three is distinctly weaker, and the amount of horizontal traversing expected along a ridge or across a face is considerable,—enough to involve a greater risk to the party in leaving the inexpert man unprotected than in lessening the support for the leader or last man,—the weaker man should be placed in the middle of a rope of three. The second best man then traverses, in ascending, last, and in descending, first. The weaker man is thus protected at either end of his traverses and cannot slip far. Such an irregular order, however, must depend upon the relative inferiority of the weaker member, and on the amount of horizontal traversing expected. Its withdrawal of support from the leader, in the case of a rope of three, must be recognized as putting a lower limit upon the standard of difficulty which he, thus less secured, may warrantably attempt in ascending or descending. To put the weaker man in the middle deprives both the first and last man of the confidence of each other's sounder protection. It destroys the collective efficiency, and leaves a party of individuals, not a combination. Nevertheless, it is an order too frequently adopted by climbers irrespective of the class of difficulty expected, and even upon direct ascents and descents. It should only be considered justifiable as a means of getting an inexperienced man over particular horizontal passages; and on difficult climbs, if they are undertaken with such a novice, the order should be changed back again, even at the risk of loss of time, so soon as the horizontal passages cease, or there is expectation of only a small proportion of them to come.

In a more equal party of three, however, where two are experts and the third not a novice at climbing but only less expert in alpine route finding, whose presence in the middle does not, therefore, weaken the rope

materially, it is advisable for the second best of the experts to go in the lead in descending, or in traversing along and down big ridges of no special difficulty. He is better able to find the best line, and thus leaves the weakest of the three with no other responsibility than to attend to his own going. This is a usual order for a guided party in the Alps on long ridge work: the guide at the tail, and the best amateur, or the porter as the case may be, in the lead. The order again depends upon the comparative ease of the rock work for the man descending last.

In a party of four, similarly, if there are two weaker members, these two may well be put in the centre for any period of difficult horizontal traversing. The object is to avoid either weak climber having to make a traverse of this sort at the end of the rope and so only half protected. In this order a party of four may move only one at a time, and the best and second best men must act as fixed anchors at either end of the rope while the weaker men are successively moving. On any such traverse, wherever the leader feels that all can move together, which will not be possible unless the rock is easy enough to allow of the weakest man traversing the passage unaided, the second best man should again separate the two less expert, and so prevent their association of inexperience and its cumulative effect in case of a chance slip. On such a passage the leader or last man will not, by the nature of the case, require the support of a good second, and he will be able to spare full attention to the single novice placed behind him or, in descending, in front of him, upon the rope.

The same order may, on occasion, be adopted with a similar party of four on the long easy traverse or descent of big alpine ridges, when two weaker climbers are efficient but not expert at route finding. It is often adopted with guided parties: the guide at the tail, the porter or the best of the amateurs in the lead, to choose the line, and the other two free to look after themselves and one another.

In a rope of four, for exacting horizontal traverses or for diagonal lines up or down ridges or across faces of any difficulty, when three men of the four are of almost equal merit and the fourth alone is inferior, one of the three better men goes last, with the other two in the

lead, in ascending, and one of the three goes first, with the other two at the tail, in descending.

Where there is only one expert on the rope and two or three less secure climbers behind him, diagonal or horizontal traverses of any difficulty may never be attempted, unless the leader is prepared himself to hold the rope and belay the advance of each of the others separately, and in his turn, across every doubtful passage. No climber, however good, can count on checking in time the fall of two others; and if one novice slips on a rope so constituted, and the jerk comes first on another inexperienced climber, it is too late to hope to be able to stop the catastrophe. The neglect of this rule, one which it is difficult for a man in the pride of strength and skill to observe, has been the cause of some of the most melancholy of accidents.

There is one variation in the order, only coming into question in big alpine mountaineering, that must be mentioned separately. Occasionally on the traverse of long level or gradually inclined alpine ridges, up or down, where the technical difficulty of progress is not excessive, but where, owing to serrated ridges, cornices, snow-covered towers, etc., the risk of accident is greater than the difficulty, and the safe and swift management of the rope is both intricate and important, it is wiser for the most experienced climber of a party of three efficient amateurs to go in the middle, and not in the lead. He can then manage both ropes, and leave his less expert friends free to attend only to their own holds and progress, while he has them both, as it were, under his hand. As some compensation for the extra hindrance which the management of the two ropes will put in the way of his own climbing, he has the protection of the double support himself from either end. This order will be found of service in saving time and in preventing risk where, as often in amateur parties happens, the rope contains one or more brilliant climbers, good enough to lead and to follow, but still inexpert in the advanced technique of the rope. Variegated alpine ridges of this broken, crested type are the final test of rope management, and progress is often quicker and safer, for a party so constituted, with the expert leader acting as pivot and anchor in the centre.

This sort of combination, one or two more experienced

mountaineers with one or two fine but still inexperienced climbers, is frequently the party preferred by guideless British climbers in the Alps; and it is therefore worth while adding here that the same order may be soundly adopted, with such a party, not only on traverses of ridges, but on big alpine ascents of length and severity. It is especially important in such combinations for the accepted leader, like a good stroke, to keep something in reserve. Assuming he knows his men to be good crags-men, he may consider himself free to put one of them in the lead in ascending rocks, for part of the day at least, himself retaining the discretionary power which is as well exercised from the position of second man, and keeping his actual strength in reserve for real emergencies or for situations calling for expert mountaineering rather than for rock climbing technique. If his object is to train his men, he is even better able to do so from this position. This forms no exception to the rule that the best man should go first and last on new ascents and descents, and on all climbs where the difficulty requires an expert mountaineer, in the lead in ascending or at the tail in descending.

The Order of Merit.

To be able to go first and get up difficult places, although a fine quality and necessary where only rock climbing is in question, loses its unique importance when large mountaineering expeditions in the greater Alps come into consideration. It is the combined efficiency of the party in this case that chiefly counts. Qualities of management, ability to contribute the most to the combinations of the party, to its reserve of power, confidence and cheerfulness, and so to increase its continuous effectiveness, are the marks of the 'leader' in great mountaineering. The better mountaineer may not be the better able to go first up passages of excessive difficulty, and may, on occasions such as I have mentioned, even operate more potently from the centre of the rope.

There have been cases of mountaineers who have seldom if ever led a big climb, but to whose management, reserve power and cool judgment the successes of their party, under whatever first man of the moment, have been really due. One must not only see a rope in action, one must climb with it, if one wishes to discover the actual 'leading' mountaineer of the party, who is contribut-

ing most in a long day to the collective efficiency and safety.

For the same reason we are not in a position to assign individual credit for the great mountaineering feats of the past, or to say of a mountaineer, "He always had first-class guides; he never led; they did his mountaineering for him;" or of an amateur, "He always led his friends: his was the credit!" It may safely be accepted that on great alpine climbs, if the party has succeeded, the success has not merely been due to the guide or first man. On such climbs there are whole hours of the day during which the slip or shortcoming of any single climber may be fatal, and where the fact that even one man draws his unfair share from the pool of efficiency can prevent any chance of success. To the whole party belongs the credit for a great climb. Its members alone can venture to say whose was the moving spirit, or what was the order of merit.

The Order with Beginners.

Beginners may be either real novices, or only beginners in alpine work, route finding and so on. A complete beginner is more bothered by the management of the rope than anything else; therefore it is better for our progress to let him come up last and go down first. The exception is when we are descending by a route which is not easy to find or retrace. We may then put the beginner one from the end, in a party of four, with a route finder ahead and two sound men behind him. In a party of three we may put him in the centre; but not when the climbing is too stiff to justify our leaving to the last man all the tasks, of coming down last, looking after the beginner, and seeing that the beginner looks after the rope of the route finder. With such a party, on such a descent, I have often preferred to put the best mountaineer in the centre, behind the beginner, to coach him as to the route and look after him, while the other expert descended on a short rope behind, and looked after himself. Often he is more comfortable if he unropes altogether. The justifiability of this inversion of the order must depend upon a judgment at the time as to the relative importance of protecting the last man or of finding the right route at the right pace. If the rocks are really difficult, the beginner should go first, and the expert behind must coach as to the route.

Such an occasion seems to me the only one that really offers a good case for the continental practice of putting red paper under stones at suitable points, to guide the descent. As a rule, a man ought to be able to find the way down where he has gone up. It is an important part of a beginner's training to learn the habit of turning and noting the look of passages from the reverse direction while he ascends. In all cases of a descent where no previous ascent has been made, the permissibility of any alteration in the usual order must depend upon our estimate of the difficulty for the last man. If the rocks are severe, the ordinary order must be preserved.

A beginner is always greatly hampered by the rope on both sides of him; and if we are making a big expedition where progress and good temper are of more importance than a lesson in 'middleman' work, it is better, when consistent with safe mountaineering, to arrange that he is either on a rope of two, or at the free end of a rope. Again, be it in a large or a small party, it is always well to put him, or her, definitely in charge of some one, if not of the leader; who will precede him going up and follow him down, whatever the other order on the rope may be; acting as coach and general buffer.

For the same purpose, in a rope of three on easy ascents, while one of the two good climbers leads, the other is often better placed climbing immediately behind the beginner, shepherding his or her feet, giving shoulders, steadies, etc.

In a rope of four, similarly, on easy or moderate ascents, we put one of the three better climbers behind the beginner. The man looks after his own rope, and is of more use in coaching, helping and succouring the beginner than he would be as an extra reinforcement above. This is the soundest method with women novices or children. It is not suitable on really difficult rock; but then neither are women novices or children.

A single expert taking two such beginners up a very easy climb, more especially if they are girls or boys, whose stances and holding-power for each other cannot be depended upon, often does best to put himself in the middle of a long rope. He ascends first and descends last, as usual; but by this arrangement he can himself bring up or lower the two beginners separately

to or from each stance, with less confusion of ropes. On very easy ridges, with a light following, if he ties himself between them so as to leave the ropes of different lengths, he can often save time by bringing up both beginners simultaneously, one starting after and climbing below the other.

An expert climbing with two such novices should always himself, before attempting any passage not absolutely easy, see that the rope or ropes to himself are anchored at the end close to his following, leaving free for himself the full run-out of rope he will require. He should never risk their security in case of his slip, or his own security while climbing, by allowing the rope to be paid out as he goes by anyone ignorant of its management or too weak to check his fall.

On British climbs, such as may be, in their general difficulty, permissible to attempt with beginners, there are sometimes passages, say of slabs, which a novice weak in the arms finds he or she simply cannot manage without being hoisted on the rope. No expert will make one of a party of two with a beginner on any climb where he expects such a passage, unless he is very sure of a good stance above it, from which to haul, and of his own strength in relation to the weight of the novice.

In a party of three when such hauling has to be done, it saves the strain on the rope, on the second man's arms and on the novice's nerves, for the leader to wait with his second man on the stance above each particular pitch until the novice has been hauled up. He can also send down a second rope, and so divide the effort. If necessary, he unties from his end of the rope, in order to have a second rope to send down. If this is done quickly and efficiently, less time is lost than if the second man has to do all the pulling alone and on his single rope.

In such cases we must see that the haulee uses his feet to scrape with at least, and thrusts out from the rock with his hands. If he clings with hands and body to the rock, the effort, for all parties, is doubled by the friction.

Frequently on such places it is only the matter of one arm-pull or so at the start of a pitch that proves insuperable, especially for women. If there is no third climber to propel the novice, it is then better for the second man to wait on the stance below the pitch,

to pass up the rope to the leader above, and himself to give a knee and shoulder as footholds up the difficult section. The actual haul will thus be shorter; or its necessity may be avoided altogether.

On exposed cliffs it is a mistake to leave the novice alone at the end of a long rope if there are difficult problems to tackle, and especially if these include any traverses. It is trying for the nerves and not good for the style. If the party is not large enough to have one climber always in attendance on the novice, the middle man should give him or her his company as often as his first duty to the leader will allow.

If, upon easy rock, a novice is taking his lesson in leading, the best climber should follow him on as short a rope as the rocks will allow. But he must avoid bustling or flurrying him, and observe all the rules of etiquette due to a leader.

Any request from a beginner for a 'little pull,' or for putting on the rope, must be always and at once complied with. Delay or reasoning may be dangerous, and will in any case shake confidence. The rope is for protection, nervous as much as physical.

In ascending easy rock or in traversing easy ridges, all can be moving together, if the strength of the party allows it.

The Order of Moving. On difficult ascents or ridges, in a party of three or less, each moves singly. In a party of four, once the leader is up, number three may bring up number four while the leader is bringing up number two.

On steep ascents of moderate difficulty, in a party of three, if the second man is really sound and the stances allow of his managing two ropes, one running out and one running in, he may bring up the third man while the leader is still climbing. But the leader must be aware that he is doing so. In a party of four, on such ascents, the second and fourth man can always be climbing simultaneously. This double movement saves much time on long climbs.

On descents the same rules hold, in the reverse order.

For a strong party a possible variant may be mentioned. If the last man is sound, and feels himself secure, he can let numbers two and three descend to the full length

of their ropes, both climbing at the same time. Number two starts as soon as number three has run out his rope, and so he enables number three to descend another length without pause. The last man then descends to number two, moving alone. On his arrival the other two start simultaneously again. If number three, however, is not dependable enough to move entirely without protection from number two, it is sounder for number two to remain at anchor while number three descends; but the last man meanwhile descends to number two. In this case the last man and number three climb simultaneously, while number two remains at anchor between them, and descends alone.

On either system a third of the time is saved. But all such accelerations must depend upon the relative difficulty of the several sections which each in turn is descending. If the lowest man wishes to be secured over a section, he must say so; and then number two must not descend simultaneously with him. If number two has found the passage of some section hard, he will need to give his full attention to the last man while he is descending it; and he must not then allow the lowest man to be descending at the same time as the last man.

The leader on the rope *may* be the manager of the party; but he should be, on any climb of difficulty, the best climber. His business is to get up rocks capably, and to get his party up. He is responsible for getting them out of their difficulties, and also for not taking them into them. He must know what the men behind him can do, as much as what he himself can do, on any given day. He sets the pace, selects the stances and directs the movements throughout the climb. He must be able to concentrate absolutely upon his task. He must be competent to distinguish between difficulty and danger, and to observe the differences between our two sorts of danger —between the objective perils of falling stones, storm, etc., and the subjective dangers which form a nimbus of potential risk surrounding every point of difficulty, contracting or enlarging according to the capacity of each climber dealing with the difficult point. To excel, he must be certain of knowing his normal standard and his standard of the day; be steel against spasms of mistrust,

The Duty of the First Man.

that consume strength even more than nerve; be resolute in advance, as resolute timely to retreat.

Most leaders have their personal tricks when 'all out.' Some are Olympian and impassive; some talk to themselves; some like to lull a hostile pitch into security by loudly protesting its hopelessness, with half a hope of catching it unawares; some like to hum or whistle; others have a tune or phrase running in their heads—most of us know the comfort of working our muscles to the accompaniment of some rhythm, audible or imaginary. Consciously or not, every leader draws upon the pooled confidence of the men behind him. In return he owes it to them to cherish the confidence so far as he can. He should avoid sharing his doubts over some difficult place with his friends unnecessarily. They cannot help him, and he will only undermine their confidence. He should never make demonstrations which may alarm those of the party who cannot see their true origin, or be of any use if they could. If he has a well-tried second, who knows too much about him to mind, he may let off steam to him. A little mystery and silence are rather a good fault in a first man; men do not want to be over-enlightened before their turn comes. But with a silent leader we are dependent upon a good second man to keep the party informed as to what is really happening. It is very depressing to be kept shivering on holds, and not even know whether the pitch is 'going,' or is even going to 'go.'

A leader's solitary battle with natural forces is so personal and isolated that it is harder for him to remember always what a heavy responsibility he carries for the whole party. No man but the leader ever knows what were the risks he ran or how near his shaves may have been. He is induced to forget them by the relieved admiration of those who have followed him on the rope, only too delighted to get up. Very few will be ill-mannered enough afterwards to recall their real feelings as they watched him take a rash chance, or tell him they thought him a silly ass. The leader has greater privileges, greater freedom and greater responsibilities than any other man of a party. To deserve them, he must never cease to study for others, never fear to decide for himself. In the words of a very great mountaineer, it is "that detachment of mind, commonly called courage, which,

combined with high powers, alone makes the great leader."

The qualities required for a good second man are all but as important to a rope as those of the leader, and are more rarely found in their perfection. A few 'born' leaders, who have learned their business by long experience, are independent of actual help and advice; but all leaders are, consciously or not, much influenced in their standard of the day, by the feeling of the spirit or the experience that is backing them immediately behind. A first man capable of rock work of the high modern standard must possess a 'temperament.' He is often a man of moods. The limit of physical possibility is so constantly approached on rock, that only men capable of high nervous concentration, able to call out their full strength and borrow again from their vitality and will, can keep their standard of performance securely up to the level demanded. In such performance the faintest doubt in the leader's mind of the confidence or capacity of the man behind, the merest suspicion that his second man is not absolutely sure of his own stance or confident in his, the first man's, leading, may lower a sensitive leader's ability twenty or thirty per cent. The leader's mind is distracted; his concentration on the single effort is dissipated. Even good, sound climbers, who take the important second place on the rope without knowing its duties, may retreat day after day to the inn speculating with their friends why their leader has so suddenly 'gone off': quite unconscious that they themselves are alone responsible. The leader himself may be, crossly, unaware of the reason. Not infrequently in such cases, in a vexed reaction from constant turnings back, he loses his better judgment and forces himself to attempt something reckless the next time he goes out. This will do him no good; nor will anything, until he changes his party or finds reason for better confidence in his second man.

The Duty of the Second Man.

A great university stroke used to say that, give him a good 'seven,' and he didn't care how the rest of the boat was manned. Almost to the same extent, a good second makes a rope. He should be strong, able to give a shoulder, arm or hand, and to carry his leader's sack as well as his own. He

Backing up, metaphysically.

must be a fine enough climber to be able to follow up a step or two in the most awkward places, and thence to spare a hand to rest the leader's strength or give him a fresh start. He must be equable in temper, optimistic, and, whatever his private thoughts, never less than cheerful. Above all, he must have the knack of transmitting his own feeling of confidence, so that the leader may feel a comfortable current of reassurance coming from his second's secure stance to his own precarious advance. If his leader is of the highly strung, nervous class from which many great leaders are drawn, he must learn to gauge him exactly, know what form he is in, and decide whether he is up to doing the particular problem, so far as his climbing powers are concerned. If he decides he can, he must lay himself out to give just the quiet encouragement that will put his leader in the right state of mind to use his powers at their best. As to how he effects this, much must depend on the personality of the leader. Many a leader objects to being talked to. Conversation is generally waste of climbing time. He may take council how to do a place beforehand, but once he has started it will only disturb or distract him to hear advice or be asked anxious questions. None the less he is often quickly aware of the ' atmosphere ' behind him ; and he becomes conscious, without words, if his second's attention wanders or if his confidence is wavering.

For this reason it is bad form, as well as a sign of inattentive mountaineering, for men to chatter to one another while the leader is doing something that requires all his skill. Much of his individual power is drawn from their sympathy, that should be then centred upon him alone. And this applies not only to the climbing of the leader. It is quite as bad form for him, when he is safely up, to exchange airy jokes across the head of another climber in the throes of a passage. A word or movement heard, or still worse, half heard, takes off the climber's attention and dissipates the concentration necessary for a delicate balance or a supreme hoist.

Some leaders like asking questions about their difficulties, to which they expect answers, without any intention of attending to them. Others let off steam by declaring that it ' won't go,' or they're ' coming down.' Protest or argument will irritate them ; what they are really asking for, unconsciously, is the confidence note

in the voice behind them, the sense of a human sympathy that realizes their difficulty but yet feels them equal to it. It helps them greatly to be assured, by the tone more than by the words, of another expert's complete belief in their ability to proceed. The second man gives his leader not only the support of his own faith : he is the funnel to the leader of the united spirit, the mutual support, which are pooled by the party, and upon which each draws again for his individual efforts. In his more dangerous and isolated work the leader, who needs it most, is most separated from its atmosphere, and it is the second man's duty to keep him in touch with it, to control, as it were, the signals and air-pipes that keep the diver in touch with humanity and reassure him in his work.

At the same time, the second man should relieve the leader in difficult climbing, as far as possible, of all unnecessary physical labour : for instance, avoid asking help for himself with the rope ; relieve him of pulling up the rest of the party ; carry the sacks ; and so on. He must be able, at times, to manage the leader's rope and that of the man behind himself simultaneously. He has at such times to control the movement of the party, and determine when it is proper for the next man to start. He must decide where it is safe to let his leader run out his rope, with no more attention than will suffice to prevent it catching, and where, on the other hand, his rope will require every attention. His rope, belay and stance technique must be as practised as his judgment. If he decides that the passage is beyond the leader on his standard of the day, he should take the responsibility of saying so definitely, and share the vexatious responsibility of turning back. If a leader has been ' all out ' on a pitch and yet failed, his judgment will be for the moment disturbed, and his decision as to whether he will try again or turn may not be a considered one. But if he has learned to trust his second, he will take his opinion in preference to his own, even though he might be himself considered normally the manager of the party. If it be to go forward, in spite of preceding failure, then he will renew his attempt with redoubled confidence ; if it be to turn back, he will have the consolation of feeling that his second man was in the best position to watch the original effort, and was there-

fore better able to judge if a new attempt could succeed under any circumstances.

The second man has thus a most responsible position. While the leader is converting himself into a motor engine to get the party up the climb, the second man, even if he be not accepted as such already, becomes the temporary manager or mind of the party, conscious of it in all its mechanism, and not only of its dynamic leader. In severe rock climbing so much of the leader's energy and time is spent on the physical struggle and in isolated situations, that the position of second may become for hours together the really vital one on the rope. His selection and education should be the first consideration for a party of ambition or merit.

Backing up, physically.

In discussing the order on the rope, we said that on all exacting rock the second man without exception backs up his leader, behind him going up, in front of him going down. On easier passages he may either lead the rope on a descent, or come between two weaker climbers on an ascent or descent.

The duties involved in backing up depend upon the situation. If the passage of descent to be made is long and holdless, and the leader, after letting the rest down, is unable to make use of the double rope, his second should remain as close as possible to him. A good second, from very sketchy stances, can often give just that touch of help or direction which makes the last man's descent less solitary and precarious, and is of more use to him than much anchoring of his rope upon remote platforms below.

In ascending, again, by putting a hand or an axe under a leader's heel when his toe is not over-secure, a second can often give his leader a security greater than his own may be at the moment. In fact, the duty of the second man, if he judges the place will go at all, is to sacrifice his own comfort and do anything that is not a definite risk to help the leader to get up more safely. A touch to his balance or foothold, judicious and opportune, is worth more as a protection than nine coils round a billiard-table boulder would be to him after he has slipped.

But backing up is subject to certain restrictions; a second must remember that he cannot do two things at once. If he helps with hand or shoulder or head,—that

is, in climbing parlance, if he selects to identify himself with the active rope,—he has generally to sacrifice much of his value as buffer or anchor-man between the leader and the party. To be justified in so prejudicing his security as an anchor, he must feel wholeheartedly certain that his leader will not fail. It is often difficult to find a position of compromise, such as will allow him really to help the leader and also to retain his protective anchor for the party. He must be guided primarily by what he judges to be best for the collective safety, and only secondly by what contributes most to their success in getting up the climb. If he decides that no backing up on his part can make certain the leader's ascent, whilst it sacrifices, in the attempt, his anchor in case of his fall, he must stay by his secure anchorage, and to such extent diminish the leader's chance of success. But if he sees that his backing up can just make the difference to the leader's safe and certain ascent, he is free to combine the claims of safety for the party and success for the leader, and move decisively and promptly to the leader's support.

For a second man compromise, in such a choice, is always ineffective and sometimes dangerous. As one small instance: partly with the idea of doing both things, and partly from nervousness, many inexperienced seconds cling as close to the rock as they can when they are giving the leader a 'shoulder,' so as to remain more secure themselves. This is wrong. The nearer his human support stays to the rock, the more difficult is it for the leader to keep his balance as he stands upon him. If his second man then rises, as is often required of him, so as to give his leader an extra lift, as he stands on his shoulder or his hand or his head, his nearness to the rock thrusts the leader's feet inward and his balance outward. The second man, when he gives a 'shoulder,' should aim at giving a really secure step on knee or hip or shoulder or head (for a good second can make his body a regular staircase, and painlessly, if he makes the right adjustments) as far away from the rock as he can securely thrust himself, even to full arm's length. He is then in a position of some use; and should the leader's re-descent be necessary, he can sometimes let him pass down inside, between himself and the rock. A good hold can be given, on a firm stance, by making

a stirrup of the locked hands for the leader's foot, and then straightening the back with a lift.

The tightened muscles of the thigh, well above the knee, give a painless foothold. The strong muscles at the junction of the neck, back and shoulder of a stooping man, but not on the point or in the curve of the shoulder, are good for a foothold The hip-bone, provided that the leg using it is pressed close against the ribs over the hip, makes a useful foothold for a man descending from the shoulders.

In making use of these anatomical holds, the climber must remember never to shuffle or screw his boot once it is placed; otherwise the human frame is good for far more use than its owner will usually tolerate. I have had a guide of some weight, but of delicately managed feet, walking from my shoulder to my head and back again for twenty minutes, while he was trying to noose the lower pinnacle on the Charmoz, without feeling any great discomfort.

The second man should never give a leader so climbing any push or lift that will come to him unexpectedly. It is not uncommon to see a second man grasp a leader's foot, as soon as it moves off his shoulder, and shove it indiscriminately upward, regardless of the leader's balance or the holds he may be designing to use. The human ladder is only of use in so far as the leader can calculate exactly upon its location and function; it must remain for him as passive as any part of the rock he is engaged with. He steps from the thigh, puts his knee on one shoulder, and brings his other foot up on to the other shoulder; or he clings up his second's back, if the second is standing upright, by knee pressure against his sides. Once he is up, he must know exactly where he will be able to put knee or foot in returning. If he has to descend from the rock on to his second again, he need barely use his boot at all. The instant his toe has discovered the position of the shoulder below, he can slide his leg down the back and let himself slip down, and the friction of the two surfaces of clothes will regulate his descent until his hands have reached the supporting shoulders. He must cling as close as possible to his second's body and bend inwards, so as to relieve the outward strain upon his second's balance, and he must never let his descending weight pull upon him askew.

The instant his leader is up and at rest, by the help of his impulses, moral and physical, the second man should prepare to follow, and as he approaches the leader's stance he should notice exactly how he has placed himself, so that when the leader moves out he can put himself in the same position for holding. There should be no need for him to have to 'get comfortable.' If the third man is required to come up before the leader starts again, the second man should at once call, "Come!" and not wait to be asked, "Are you all right?" These seconds are, cumulatively, most valuable. In a good party the third man will be ready to start the instant he gathers that the man above has taken his stance.

The Duty of the Third Man.

In big alpine climbing, or on long mountaineering expeditions in general, yet another group of duties comes into prominence which cannot well be discharged by the leader and second man, who will have sufficient to do in looking after their respective functions. These create the position, for such climbing, of what may best be termed a 'third man,' though the party may consist of four or more, and the duties may be subdivided. If the second man's duties may be called 'backing up,' the third man's are those of 'following up.' He must be strong and able to carry, so that the spare rope and sacks of the leaders in really serious situations can all be discharged on to his shoulders without hesitation. He must be expert enough to manage a belay for both his leaders, if the situation demands the second man backing up the leader on an exposed passage, and be able to give them at least the moral support of his sound anchoring of the rope. He must have no false pride, and be prepared to get up himself as best and quickest he can, using the rope to save time. He must be always patient, ready to stand and shiver in his steps without complaint while the difficulties are solved. He must take the inevitable loosened stones, flying ice-chips and cleared-off snow incidental to his lower position with a hardened heart and, if possible, on a hard head, with no more than reasonable protest, and be able to see the humour of snow melting down his neck with the cheerfulness that it will afterwards be found to have caused to his friends. He must be prepared to go last, behind any weaker member, if there be four or more men in the

party, and to look after him, following him up closely wherever he is able, without expecting help himself or much attention to his own rope. He must be good-tempered, ready to set the example of accepting decisions to turn back without discussion and even without knowing their reasons, and prepared in crises to remain quietly reassuring without bothering his occupied friends with questions. His use is, directly, as a support of strength and cheeriness to the leader and the second man if the serious nature of the climbing demands their combined preoccupation, and, indirectly, as an example of genial co-operation and 'following up' to other members of the party.

In a sense every member of the party should be a 'third man'; but in big undertakings it is of undoubted help to the leader and second to have one man upon whom they can specially rely to look after the humour of the rest in the trying times of waiting while they themselves are working out the difficulties; to relieve them of the minor tasks of carrying and directing; and to come up without pride or protest in inconvenient ways, to inconvenient places, at convenient times.

More about the Rope during Climbing.

During all the intricate manœuvres incidental to combined climbing, the watch on the rope may never be relaxed, and a few further hints as to its management may be useful to leaders and followers alike.

With a rope, as with a horse, anticipation is the secret. Once it catches, or kinks, or entangles, the result is nightmare. Of its control, when men are moving together, I have already spoken: the perpetual glance, and flick, and swing, to keep it free, that must become subconscious.

In climbing singly on steep ascents, the rope, as it is drawn out by the man climbing above, must be watched as well as held, and warning must be given to him that it is running out at least four feet before it is taut. This is a primary rule. To jerk the man climbing, by a hitch, or to let the rope closure his advance without sufficient warning, is an unpardonable fault.

As we draw in the rope of a man ascending or descending to our stance, it should be gathered in neat coils, near the belay if one is used. Above all, it should be laid well out of the way—at the back or side of the stance.

In pulling in the rope we must always consider exactly where the next man will come up and how he will stand; and lay his coil, as it runs in, as well as the coil of the man ahead, which is running out, where there is no chance that the rear man will be forced to 'cross' either rope. If our hands are occupied with holding or with the belay, so that we have no time to coil it down, the slack of the rope should be flung evenly over the arm, or somewhere out of the way, as it runs in. The moment the next man is up it should be passed to him in its chance coils; or else, if it has coiled down neatly, it may be left lying where it is.

If a belay has been used, the end of the rope running in should be taken off the belay as the next man reaches the stance, while the end of the rope nearest our own waist is put over it, lying always in the direction in which it will afterwards have to be paid out. These operations have to become practically mechanical. The instant the next man takes our place on the stance and imitates our last position, the rope, rightly laid, should be ready to his hand.

On severe climbs there is often not room for two men at the same time on the same stance or platform. To avoid any awkward juggling on the ledge, it is best for us, if we are holding, to move a step or two from the belay, so soon as we see the next man has got a good handhold near the stance that will bring him securely and immediately to the belay. In this case it is essential for us to leave the ropes lying exactly right, so that the next man may take position to protect himself, and us, with the shortest possible interruption to the safe continuous anchor of the rope.

The man who is actually climbing is the man first to be considered. To clear the way for him we must be prepared momentarily to sacrifice our own comfort or solidity. This may seem a commonplace, but it requires quite an effort of will. I have remarked even among good cragsmen that seven times out of ten they wait too long on the stance, until the next man is on the top of them, and ropes and legs are all in a muddle. But when, with the object of leaving the next man room, we move out of his way off a stance, we must take note exactly of what is going to be our own line of advance when he is secure and we start the next section; and we

must avoid moving into any position which will mean repassing and unsettling him, or even, as one sometimes sees done, climbing over him. Apart from the risk to his and our own balance, we shall almost inevitably entangle the rope by a switchback of this sort.

In pulling in the rope of an ascending man, we should be mindful to keep it just taut, but never tightened or tugged, unless he calls for it. It requires some education of touch to distinguish between the three. Guides are wretched judges in this respect. "Don't pull!" "Nicht ziehen!" "Ne tirez pas!" is the groan of protest that eddies all the week round alpine centres. But the guide remains convinced he merely had the rope 'taut.' All leaders who have never or seldom practised going behind on the rope are apt to make the same mistake. The complaint is constant. The difference between 'taut,' 'tightened' and 'tugged' is best learnt from below.

On the other hand, many climbers who have never led are equally unconscious of the difference, and of how much they owe on occasion to a discreetly handled rope. "You didn't pull me there!" or, "I did *that* without the rope, anyway!" are the common forms. Only a climber experienced in balance can honestly distinguish between the constricting tug that takes his whole weight, the taut rope that is only precautionary, and the delicate tightening that just serves to keep his body in balance and so allows freedom to hand and foot to find easy holds. The first is called "using the rope," the second "without using the rope," and the last guileless but material aid to adjustment is often euphemistically entitled "the moral support" of the rope.

I must repeat that, however easy the place or good the climbers, a man who calls for the rope, or a pull from the rope, should always be helped at once. Inexperienced climbers are incurably prone to argue that the rope is not really needed. Some accidents have been caused in this way. The rope should be put on before rather than when it is really wanted.

The rope of a man descending to our stance, especially of a man descending last, demands no discernment between subtler strains; but it requires even more adroit handling. It must never be jerked or tightened, which may pull him off his balance holds. If it appears to be

catching on intervening points, it must be loosened with the lightest of flicks : a strong flick will run up the rope and jerk him like the crack of a heavy whip. It must never be left loose to drag or catch close to his feet, where it will get in the way of his foothold or get round his feet or legs. If he has a long rope out, the weight alone of the rope, if we hold it anything like taut from below, will drag on him. It is best in such case to keep it sliding gently down the rock towards us. As the climber moves down, a very slight motion of our hand will just free it, without taking its weight off the rock.

Our eye should never for an instant leave a man so descending to, or ascending from, our stance, so that if he finds it necessary to reascend or redescend a few inches in order to better his holds or position for the next movement, we may at once be ready to relax or take in the extra coil he requires or releases. If he is out of our sight while descending towards us, we watch the rope, which tells us as much as the sight of the man. If he is out of sight while ascending above us, our feel of the rope as it tautens or slackens will tell us almost as much as sight or speech. But a man ascending or descending out of sight below us will have to tell us what he wants, if it is anything more than the usual steady playing, out or in, of the taut rope.

If, as often happens in the case of a man who is just climbing up off our stance, the rope, owing to his having tied his waist-knot in front, or crossed the rope, makes a spiral round his leg, he should be warned at once, and we must hold the rope ready to swing it from under his foot as he raises it for the purpose. This sometimes also happens if a man is descending quickly on to our stance. In neither case must the rope be jerked or swung, to release it, without his knowledge or the signal of his lifted foot. Similarly, if a man is starting to descend from our stance, and has his rope knotted in front, as he turns face inward the rope makes a spiral round his neck or arm. A warning, and a light sway of the rope may prevent him from anticipating fate.

In climbing with beginners it is always worth while seeing, before they leave our stance, that the knot of their waist-loop is secure, and pulled round well to the side, under the arm. For ascending, the rope should run up straight from the knot, in front of the shoulder ; for

descending, in front of or behind the shoulder, as balance and the angle of the rock suggest.

A very risky practice, common with beginners, is that of using the active rope as a handhold in difficulties, to pull themselves up by. Unless they can reach a balanced position in one pull, they are forced then to keep hold of the rope for their balance, and to take yet a second and higher hold upon it for their next movement. They are thus accumulating a quantity of slack between their point of dependence from the rope and its noose on their waist. And a slack rope is full of dangers. If their grip fails, they fall all the length of the slack, and the rope may break. If it does not, the man above will be subjected to a most unfair jerk, of whose possibility he may be all the time unconscious. In any case, the climber is depriving himself of the steady help and protection of a rope, pulled in taut from above, on just the passages where he has found himself least capable to cope with the difficulties unaided. No climber should use the rope as handhold without full warning to the man above, and without making certain that he can in a single pull reach a balanced stance, where the rope can be again drawn taut upon him.

With Stones.

To avoid sending down stones with the rope is a sure test of expert climbing. A climber's responsibility in this respect extends the whole length of the rope between him and the companion whose progress he is superintending. In the case of a man above us, we have a personal interest in seeing that his rope does not drag over loose pebbles or catch on disintegrating points. In that of the man below us, our personal interest may be less, but it will be no less appreciated. It must be remembered that the rope as it comes in taut will touch and dislodge much that seemed out of its range when we selected its line of pull-in. An inspection should be made to discover if there are any pebbles lurking just over or on the edges over which it will pass. These last are a special danger in couloirs or British gullies, which consist largely of steep pitches surmounted by accumulations of loose scree. It is often safer and more tempting to move up to the top of these scree spits and not to anchor on the immediate lip of the pitch. Great care has then to be taken to remove all loose stones from the line of the rope; for

the rope when taut will drag over the edge of the pitch, and even apparently firmly embedded stones may work loose under its friction when it is too late to move them into safety.

If a rope length has been allowed to sag against the rock, it must not be pulled in or jerked free hurriedly, unless we can see that there is nothing it might loosen. Over surface visibly friable or pasturing stray stones the rope must be kept from touching at all—a delicate task in continuous going.

When men are all moving together, and our hand, while seeking for its holds, is also charged with loose coils and the task of freeing the rope, it is often difficult to combine an attention to all the loose stones that may be caught by the swinging coils with a simultaneous precaution against possible loose stones under our feet or hands. Of course we give warning if one gets loose in spite of our care. But I must add that it is considered no valid excuse among mountaineers to plead that a stone was dislodged by the rope.

During Halts.

The rope, during halts or interruptions, should never be left lying about in a tangle. It may catch over points from which it will be difficult to release it. I remember an occasion on an Aiguille when it took a quarter of an hour to extract some loose lengths, which had jammed in a deep cleft of the slab on which we were standing.

Halts for lunch are full of dangers. Men begin to cross and recross each other's ropes, for matches or for conversation, and at the end of the halt a maze presents itself which can only be solved by long, impassioned moments of general untying and reroping. It is better for the two end men to unrope for the halt, and leave their coils ready for easy resumption.

Two middle men can only get their rope twisted, not crossed. When a middle man finds, as often happens, that the ropes going backward and forward from his waist-knot have got twisted round one another and make a bunch at his waist, he has only got to lift the upper of the two ropes over his head and pass it under his feet the requisite number of times, to clear it. Once, after an eighteen hour traverse of the Dent Blanche by the Viereselgrat, we took a midnight halt on the glacier, and on re-starting found the rope inextricably inter-

woven between the five of us. The guides were tired, too tired to unrope, or to move eurhythmically ; and the next ten minutes of frenzied gyrations, with the lanterns whirligigging round one another in the darkness among the crevasses, will remain a picture as precious as its moral.

At the end of a climb the rope should be carefully coiled up, so that the loops will run out without entanglement. To coil with the lay of the strands avoids kinks. We never know when next the rope may be needed in a hurry ; and the unknotting evolutions, the passing of the long ends, etc., are more irritating before a late start than a late return.

Coiling.

During coiling, the loops should be caught up in the hand, with the lay, and laid against one another, but not allowed to cross. For most men, especially if they prefer to carry the rope round their chest, the most convenient length of coil is that made round the sole of the boot and the knee. Some prefer coiling round the hand and the elbow.

A convenient trick for finishing off such coils is to bind the loose end once or twice round the whole mass of coils near one end, and then thread it through the smaller of the loops into which the whole coil is thus divided. The loose end, so threaded, makes a comfortable shoulder-strap, by which the whole coil can be suspended over the back. This method of fixing the end is less trouble to undo than the more usual method—to twine both loose ends of the rope through and round and round the finished coil in opposite directions, and knot them where they meet. This forms a single firm hoop to hang over one shoulder.

For this single hoop, however, a still better way to finish is to make a half-hitch on the coil with one loose end, and then wind this one end in a spiral round the coil in the same direction as that of the spiral of the rope-strands. While winding this loose end, twist its strands tight with the fingers. Their inclination to untwist will keep the spirals clinging close round the coil.

Yet another convenient and quick method of coiling the rope, suitable for short intervals of disuse, is that of linking it in ' chain knots ' : short loops are successively pulled through one another in a continuous linking chain,

and this is then swung over the shoulder. The rope should only be left in chain-knots for short periods.

The rope can be carried either as a hoop round the shoulders, or, more conveniently, hung over the shoulder-straps, as a cushion between the rucksack and the back. If it is wet or heavy, it is best to put it in an empty sack, or to fix it, by means of string or its loose ends, upright between the shoulders, like a rucksack.

If the rope is new, and has got wet, it is well to uncoil it in the evening and suspend it, neither strained nor taut, round the banisters or looped along a wall. It is wrong to strain a wet rope, as many climbers do. It stretches the twist and weakens the resilience which is its strength.

If a rope has kinked during a climb, or from being left wet in coil, in order to clear the kinks it is not necessary to untwist them with the hand. The rope need be only grasped some distance from its end with one hand and swung round circularly in the direction opposed to the twist of the kinks. They work themselves free, and the hand can then be shifted farther up the rope, and repeat the swing for another section.

The rope should never be dried in the sun or near a fire.

The rope should be examined after every ascent, and at intervals during the day, for bruises or frayed strands. A single frayed strand justifies the cutting or rejecting of the rope. An old rope should never be used. Guides are careless in this respect.

Some parties prefer to have their rope in lengths of 45 to 55 feet. Each climber is roped separately, and the middle men thus wear two waist-nooses. This method allows of rapid changes of order, of easy separation into parties of two, and so on. For most rock climbing a length of 60 feet is all that is required for the leader. A rope of 100 to 120 feet is sufficient for three. For parties of four, one length of 60 feet for the leader, and one of 90 to 100 feet for the rest, are generally found correct. For parties of two, the length depends on the character of the climb in prospect. But the leader requires more initial allowance for absolute security, since it is awkward, with only two men, for one to unrope in critical positions and give his leader more as he requires it. In larger parties this is less risky.

Suitable Lengths.

A run-out of 50 to 60 feet is usually accepted as the

maximum which a leader should allow himself, and most sound climbs on rock offer good stances within or at this distance. A few exceptional climbs need 80 or 100 feet; but their supposed number is constantly being reduced, as later parties at their greater leisure discover adequate anchorages at shorter intervals. At distances of 100 feet, or even less, the rope ceases to be even a moral reassurance to the leader, and its drag alone diminishes his security. If he has a following on such climbs who cannot get up without the help of the rope, to carry it coiled, and let it down when he reaches his remote platform, may be the safer course.

Funicula.

Our first lesson is to learn how to knot the waist-loop quickly, and how to untie ourselves. Our second, to unravel expeditiously the entanglements that invade the rope during the extra manœuvring which the presence of inexperienced climbers entails. The best end-man knot can be made with a single continuous movement of the hand. The methods of roping and knotting are dealt with elsewhere; but we must remember to re-examine waist-knots frequently, for ourselves and the inexperienced. The noose sometimes slips down or becomes dangerously loose amid the confused disarrangement of garments which stiff rocks excite. Cases have occurred where men, slipping on rock or into a crevasse, have all but fallen out of their careless waist-nooses, and have remained suspended by one armpit. Theoretically we always rope round the chest; but round a large chest or tapering ribs the rope will not stay up, unless it is too tight to be comfortable. Consequently many men, and all women, prefer to rope round the waist. Anyone who, like myself, prefers to keep the rope up round the chest, will find a convenient device is to pass the end of the rope, after tying the knot, over one shoulder, and knot it lightly on to the noose again behind. This prevents the weight of the rope, especially in the case of a leader, from pulling down the noose round the false chest.

If a climber has to make a jump while on the rope, he must give notice first, and be sure that he has enough slack rope not to jerk his friends or spoil his own jump. Beginners and boys are apt to jump in unexpected places, and to forget that they have the rope on.

On boulders and such-like problems, wherever height

and difficulty make the protection of a rope from above advisable, the climber should be roped on properly. To dangle a loose cord past him, as is so often done, is worse than useless. It tempts him to risky assays; and then, if he slips, it is utterly impossible for him to save himself by snatching at the rope.

An unroped man who calls for the rope is generally unable to free more than one hand to tie himself on. Therefore the loop, already tied, should be sent down to him, which he can work under his armpits *seriatim*. Failing a loop, he should twist the rope round his forearm; but never trust to the grip of the hand alone. If he is within reach, it is often easier to give him a hand than the rope. A hand-clasp is not strong enough for a sheer lift. Each man should grasp the other's wrist; or they should crook and interlock their fingers. This last is a very powerful hold.

Every climber should know how to make the simple hitches for sending up sacks or axes on the rope. An undue proportion of the wasted moments of my own life have been spent in unravelling the labyrinthine 'granny' knots with which well-meaning friends have plotted to protect the ascents of their sacks.

The 'stirrup' and other marabout rope-tricks may be studied in rescue handbooks. The rope, as a support, precautionary, corrective or moral, cannot be too minutely studied; but as a means of evasive traction, or detached ætherial flight, it need not occupy the mundane climber.

CHAPTER VI

CORRECTIVE METHOD

MOUNTAIN craft has for its object to get us up and down mountains without mistakes. All our training aims at reducing continually the limits within which our mistakes might occur. But human beings are fallible, and mountains are perverse. Mistakes will still be made; and it is our business to learn how to remedy them, as well as how to avoid them. Our corrective technique must seek to prevent mistakes developing into disasters; and, a further step, guide us to a right conduct when the disaster can no longer be prevented.

Climbing accidents have a theatrical appeal, because of their dramatic circumstance, and the world at large has an exaggerated notion of their frequency. Compared with other active sports, in which the element of danger is tacitly accepted as part of the fascination, climbing has a singularly clear record. Aviation, hunting, sailing, football—their toll of fatal accidents is accepted almost without comment. Only in mountaineering does the sudden and spectacular suggestion of annihilation make the isolated accident flare like innumerable stars in the imaginative public eye. And yet of British mountaineers not one per cent are killed climbing.

Human Fallibility

Although fatal accidents are extremely rare, falls, slips and missteps are common,—as common, and as a rule no more harmful than falls out hunting or skating. There are falls from over-confidence, falls from inexperience, and falls from pure accident in all active sports. It lies with the experience and skill of the party to prevent such a climbing fall being anything more than an interrup-

tion. It were better avoided altogether: but climbers are not all perfect at their start, and mountains may be perverse; and it is only sensible to recognize that mistakes must occur in spite of all precaution, and to study how to deal with their effects.

A safe mountaineer climbs without stumble, but he is also always alert to check some one else's incipient slip. The management of the rope has prevention of accident as its first object. But correction of the consequences is its second.

Giving Warning.

When men are moving singly, up or down steep rock, a fall that can injure should be impossible for anyone but the leader or last man. If the ordinary precautions are observed, a slip of a few inches is the most that can result. But although we may count upon each other's alertness, we must give the rope, and ourselves, every chance. If we feel a hold giving or muscles failing, we must give warning at once, and then hang on for just the extra second—nearly always possible—which will allow our friend above to brace every muscle to meet the direct pull, or to intrude his utmost 'spring' between the rope and the belay. There exists a superstition that to fall silently is to fall courageously. The man above is sure to hold—"that's his business"; whereas our own concern, in such extremity, lies only with our own dignity. But even in falling we remain a member of the party, and we have no right to indulge a personal gratification. And so a quick 'Look out!' and the fraction of a second's hang-on, which are enough to secure the concentration not only of the anchor-man but of all the rope, must be counted as our bounden duty.

The same obligation holds good in the case of a party all moving together along a ridge, or up or down an easy climb. If one man feels his foothold or his balance going, he has always the instant's time to shout a warning before his weight can come on the rope. The man behind, if there is one, will have had his eyes on him and will be ready; it is the man in front, with his back turned, whom he has to consider. This front man will, if he is climbing soundly, have been all along taking holds with his margin of resistance in mind. He will also have been noting, if not using in rapid passage, all the points for a possible anchor of the rope. The instant's warning

will enable him to brace as he stands, without looking round, or to fling the rope round a point to support himself before the jerk comes. In such climbing the rope is never quite taut between climbers, and there will be the run-out of the length of rope slackened by the man falling to add to the interval of time which his shout should have given for preparation.

The last man on the rope, when all are moving together in ascent or descent, has a special obligation to give this timely warning, since no one has him in view. The instant he hears the warning or the scrape on the rock, every man braces his muscles, and, if possible, anchors his rope. A practised ear distinguishes at once between the ordinary clean scrape of a climbing boot and the scuffled scrape of a slip, or the snap of a breaking handhold. On a thoroughly united rope it sometimes seems as if a premonition of the imminent slip must have reached a good climber in front, even before the sound, some consciousness of an interruption in the current of sympathetic action, so sure has been the anticipation and swift the check. But a man who has himself passed a passage has already a half-realized idea of the sort of trap it may present, even if he himself evades it, and his quickened senses are the sooner prepared for the nerve-thrill that precedes the actual warning by as much as thought can out-distance sound.

Easing the Check.

If a climber has had no warning, or for other reasons cannot at once brace into a secure position, he should let the rope slip through his hand until he has had time to adjust his balance. This is one of the occasions when gloves are a help. The first touch will tell him if he can hold fast at once or must let the rope slip for the moment. Very few falls on places where a party is able to move together are absolutely clear, or come with the full jerk of the whole weight at the start. This is especially the case on snow, where friction also checks the pace. I have had on several occasions the man above or below me in a steep snow or ice couloir fall out of a breaking step while we were all descending together. On an occasion when the man below me slipped, my first effort to check the rope told me that I was not firm enough. A second or two were needed to allow myself and the man roped to me above to get 'planted.' I partially checked the rope three times, and had to let it go again

at cost of hand and glove, before I felt the rope from the man above tighten on my waist, and so knew that we were ready to take the full jerk together, from our combined stances. The intermediate checks had broken the impetus sufficiently to make the final arrest easy. On another occasion in a steep couloir, when I was descending first, the man above me slipped, and the last man on the rope, then in mid-stride, was unable alone to check the slide at once. He therefore let the rope rush through his hand until the sliding man had spun down past me. Then, of course, my rope to him also came into action, and, dividing the shock between us, we easily stopped the fall.

On rock, as a rule, such gradual checks are impossible. Fortunately upon rock, in proportion as the need for an immediate check is the more imperative, firm stances, with sound rock hand and foot holds and complementary anchors round rock points, are more present and instantly serviceable.

Checking on Traverses.

The middle men on traverses are adequately protected, and need only be checked in the usual manner. But if a leader or last man falls, before or behind us, on a long traverse, it is not sufficient merely to hold firmly or to hold the belay. If we remain stoutly inactive, he will have enough rope out to fall far enough for injury before the rope can tighten, and far enough to risk a snap in the rope when the full jerk comes. The rope must be snatched in as he falls, round the belay or loose in the hands. If the fall is from our own level, or from only diagonally above us, we can tighten the rope at once, and this serves to give a sideways tug to the man falling, which lessens the force of the final jerk as he swings in below us. During a fall of fifty feet from a traverse on our level, there may be time to race in a fifth of the length before the jerk comes. On such traverses, except in a party of two, there will be usually some one else on our own level, or near it, who will share the shock with us by tightening his rope on our waist. If the third man is near enough to help in actually holding the loose rope, or in belaying it as it comes in, so much the better. We are the freer ourselves to rush in as much of the flying slack as time allows us. If he is not near enough to help, we must be prepared, as we cannot pull in and secure the rope at the same

time, to let the rope tear out again when the jerk comes, tightening and relaxing it through our hands until we are certain that our balance has survived the shock. The action of the party of two in like circumstance is considered later.

After the 'fall' of a man from above or on our level, or after the few inches of downward movement, more properly termed a 'decline,' which are all that a well-managed rope will permit to a man below us, it is better to lower the man down to a good stance, rather than yield to a universal inclination and attempt to haul him up over the ground he has lost before he has recovered wind and nerve. It means less effort for both.

The Case of the End Men.

A leader, or a last man down, does not fall. It is the first condition of his hegemony that he must not. His fall from any height must mean injury to himself, and may involve the whole party. In insular climbing, where distances to hotels and rescue are small and easy descents usually available, a man may, if he desires it, and his second man allows it, take the chance of falling and hurting himself, provided that his party is safely anchored. His injury then only involves certain hours of delay and dangerous exposure for himself, and such anxiety and fatigue to his friends as they may suffer in finding help and in rescuing him. But in the Alps, to fall as a leader is to fail lamentably and egregiously as a mountaineer. To fall, get injured and survive in the Alps is more actually dangerous to the rest of the party than to get killed. Its members must separate. One at least must risk exposure and other objective dangers and stay with the injured man. One, or two, if happily there are four in the party, must face the peril of descent alone, probably late in the day, certainly shaken by the accident, to seek help. The risks and difficulties of mountaineering are increased tenfold for a lonely man, or for a party returning thus shorthanded and unbalanced. More than once the partial incapacitation of one climber has resulted in the death of one of the friends who went to get help for him.

In big mountains we may not take chances, not even the youngest of us. Rock-climbers who have learned how to take their risks only for themselves on our own hills, with open eyes and in no rash spirit, and think to take them also only for themselves when they go to the

Alps, are all too commonly blind to their very different conditions and the far graver collective effects of an individual blunder. An injured man in the Alps means a crippled party. Those uninjured are handicapped in time, combination and nerve to meet the consequent race with darkness or the chances of night, and frost, and crevasse, and avalanche ; but they are forced to take these risks in double measure, at double pace, and with reduced strength, disregarding most of the usual precautions on their own account, if they are to give their injured companion a chance of timely rescue.

The Measure of Courage.

A leader or a last man in the Alps absolutely must not fall. We may accept the fact that daring leaders will take risks, and that accidents can happen, provided every leader is aware of the distinction between the risks which no man may allow himself to take for his party even with their consent, and the risks which he may take for himself alone, but which his friends will be ill-advised if they allow him to incur.

We cannot but be grateful for the spirit, though it is but human to criticize the action, of men who find joy in a contest with forces greater than themselves. Too often the profitable by-products of successful courage are alone admitted as justifications for the spirit in which adventure is undertaken. Deaths above the clouds or under the water are taken as heroic incidents, excusable in the interests of human progress. Deaths upon rock or under snow, inspired by the like and often by an even more disinterested spirit of adventure, are condemned as folly. Mountaineering must be judged by a spiritual, not a utilitarian, standard. Courage, moral and physical, that has its source in vigorous vitality and its goal in the extension of human freedom, finds on the hills its hardiest school. It is a very wholesome emulation that leads men, as their skill and power increase, to measure them against ever-increasing natural difficulties. Our competition with the mountains injures no other human competitor by our success. Our conquest of them ends only in the conquest of ourselves. During these last years by none has the sacrifice been made more willingly than by our younger climbers. Their courage was that of the races from which they sprang: to mountaineering they owed its discovery and its training. We may not reproach it to the hills if the self-reliance

they teach leads, here or there, some high heart into danger, before their harder lesson, of experience, has been learned.

And having said this, I must repeat that a leader in the Alps or big ranges, before he takes a chance, must make certain that the risk will be confined to himself, supposing such certainty can ever be attained. When he has made as certain of this as he can—he must not fall!

But still, miscalculation is possible and accidents may occur. A hold may have broken, and an end man, leading or last, has fallen. In the case of a fall, the second man's duty is to the party, and only in so far as the greater includes the less, to the leader. The leader has endangered the safety of the whole rope, which lay in his hands, by risking a fall; the duty devolves upon the second man to counteract the further consequences and to take up the leader's duty to the collective security of the rope. No leader who deserves the position will have fallen on any but difficult rock, where the party are moving singly and where they are properly secured. His second man will therefore have him either well belayed, or be in a position calculated to meet the chance of his fall. On steep upward or downward climbing he will rarely be able to pull in much of the rope as it rushes past. If he is alone on the stance, he cannot take the chance, as a man often can on a traverse where he is well backed up, of doing anything that will risk the final jerk catching him unprepared. If he, too, falls, it is seldom that others of the party can arrest the twofold fall. His corrective action is practically confined to doing all he can to spring the rope, with arm, hand or body, so as to lessen the chance of its snapping.

The Second Man's Action.

It is one of the more serious attractions of climbing two alone, that the two men can divide all responsibility equally, and take their chances happily together, without one of them ever being placed in the painful position of choosing between two duties. In a party of two the second's duty is only to his leader. He shares in the decision to try or not to try. If the attempt fails, and the leader falls, he holds him or he falls with him. He can give himself wholeheartedly to his first natural impulse, which is to associate himself entirely with the man in danger. If it is the best chance for both, he will

hold the belay, and let the rope take its chance. But he is free to take a greater risk for himself by attempting to rush in the rope or by hazarding more of his direct intervention between the leader and the belay, if he thinks that by so doing he can lessen the even greater danger to his leader of the rope breaking. The decision, like all a second man's decisions about his duties, is difficult, and must be made like lightning; but in a party of two it is at least not complicated by any hurried alteration in the order of his duties, such as follows upon the fall of a leader in a larger party. His first duty, in that case, is to the rest of the party; the duty to the leader descending, with him, into second place.

After a Fall.

If a leader has once fallen, even if he is not physically injured, he must be treated, for the time at least, as no longer in control. The second, in consultation with the rest of the party, must decide whether advance is still possible. No man's judgment, nerve or temper can be entirely unaffected by a fall, and even if the nerves appear unshaken at the moment, a reaction follows later. Our object must be to postpone this inevitable nervous reaction, both for the man and for the party. If the leader is uninjured, action is the best restorative; and I believe the wiser course often is to encourage him to resume the lead, and so force himself to concentrate all his faculties upon his immediate task, and on that alone. It requires some confidence to do this; but if we know our leader, and have been justified in allowing him to try the passage at all, it is best for him and best for us to let him feel that our confidence is not diminished, and that he has still a first duty, to bring his party through the difficulty. The reaction will thus be postponed, at least as long as the necessity for serious action continues, and may be put off altogether.

If the leader is really nervously shaken, he will know it at once himself. He must then be rested, and the second takes over the lead. But the preservation of the *morale* and good spirits of the party, including the leader, must be the first consideration. There should be no hint of criticism, even of words or tone, in any rearrangement which is decided upon. The affair should be treated at the time lightly, as an incident. If the leader has blundered through inexperience or a real defect of judgment, or if the second has grounds to think that he is

off his day or has been taking unjustifiable risks without consultation, reasons which would make it unwise to trust him for the rest of a severe climb, it should be quietly assumed that he does not wish to continue leading. Any moralizing or implied reproof will only hinder the recovery of equanimity in the case of an old hand; and in the case of a less experienced man, or of one leading on his trial, criticism is better left for some more leisurely occasion.

One coincident effect even of a slight accident may perhaps be mentioned. A number of strong men, climbers among them, turn faint at the sight of blood, especially, seemingly, in times of nervous strain. They are often unaware of the tendency until the occasion arises. Even if they foresee, they cannot overcome the attack; but they can give warning. It has twice happened to me to see mountaineers of physique and nerve faint in their steps, once on ice, once on snow, when a guide had cut his hand in front. On the one occasion we had two minutes' warning, on the other none.

If a climber is injured by his fall, more severely than will allow of his climbing unaided, surgical ministrations are the first necessity; with these I am not dealing here.

Accidents.

The subsequent action must depend on the place and people. If it is possible for the party to convey him at least as far as some sheltered place where help can easily reach him, this should be done at any risk. The chief danger is collapse following on the shock, and his period of cold and exposure must be shortened even at the hazard of increasing the local injuries by moving him.

On rock, if the party consists of four men, and one is strong, the injured man should be slung on to his back by slings fixed round his shoulders and thighs, and the rest of the party must assist the loaded man with rope and hand. On easy rock men can act as the bearer's crutches, to take part of the weight On steep rock where carrying is practically impossible, especially if there are only two or three to bring him down, he can be lowered over difficult places, suspended in the triple-bowline chair or tied firmly and rigidly to the rope, according as the injuries permit. If possible, two men should lower, using ropes from different angles

above, and one should guide from below. If he is unconscious, his head should be supported by an extra sling to the rope, with a coat as a cushion round which the extra sling is passed. A broken leg should be bound with putties between ice-axes, or to one ice-axe and then to the other leg. A broken arm should be strapped with a puttie across the body.

On steep snow or ice, where carrying is impracticable, it is best for one man to convert himself into a sledge, to lie on the snow, take the injured man in his arms, and let himself be lowered on the rope, in steady stages, down the slope.

As soon as the lower slopes are reached, one man should go off for assistance (two, if possible, when glaciers are in question); and meanwhile a stretcher can be made of cross-linked rope, or of boughs or axes combined with rope. It is well to remember that carrying a stretcher over rough ground is exhausting work, and not to spare men in the rescue party. With a heavy man rapid shifts are necessary, and twelve men have been found barely sufficient to bring down a heavy man with a broken leg, in the dark, over some hours of broken ground. If the ground is too steep for a stretcher, and too broken for lowering on a slide, it is best to use a blanket or a web of rope; upon this the man can be lowered sideways, stage by stage, the men on the under side holding up their edge so as to keep the lie level. If the ground allows of the stretcher being carried freely, but is still inclined, one or, better, two men should act as a brake behind, pulling back on a rope attached to the stretcher. During the descent, one man familiar with the ground should be sent ahead to select the easiest line. A carriage or car should be brought to the nearest point of the road or track. The surgeon should have been already sent for by any available car or horse.

If it is impracticable to get the man down until the rescue party arrives, by reason of the difficulty of the climbing or the weakness of the party, one man at least must stay with him, and the other, or more happily two others, must make all speed consistent with caution to get assistance. An injured man must never be left alone. If the descent is severe, the two most capable should descend; and they must remember

that even more depends upon their getting down safely than upon their getting down quickly, and resist the insidious recklessness and 'it-can't-be-worse' spirit that affect the nerves of all men at such times.

A code of signals, of shouts and lights, should be arranged, if not already known. This is most important, and often forgotten. It is wonderfully cheering to hear the human voice. Nothing serves better to sustain the spirits and keep off dangerous lethargy or collapse than the shouts which let the waiting men know that their friends are safely down, and help assured, or which hearten them on the return long before the rescue party can reach them.

With the same object, if the rescue party cannot start at once, lights should be flashed at night from some point in the valley visible to the waiting men. A single match is visible for miles.

The simplest code of call for help is six shouts or flashes in the minute, followed by an interval of a minute's silence. The reply, signifying the call is heard and understood, is three shouts or flashes in the minute, with a minute's pause. But men do well to arrange, and write down, a fuller code of communication before they divide on such occasions.

Rescue parties, of guides or local people, are often slow in getting under way. If they find they cannot get a sufficiently strong party together at once, the friends or, if possible, some good substitutes, should form an express advance party, taking the few first necessaries and making the best pace they can. Of even more effect than their physical restoratives will be the moral reassurance they bring that the real rescue party is under way. Waiting and uncertainty materially lower the nervous resistance to injury or exposure. The men most concerned should not leave the dispatch and direction of the main rescue party to the professionals or the local people alone, who will always claim it as their business and, more from ignorance than lack of sympathy, often treat it as a function to be lingered over and discussed in all its details. Not infrequently in the Alps the first men to volunteer will be the idle and unemployed, and therefore the least competent. The officious local man, who may be only concerned to

see his name in print and get credit and shillings, is particularly to be guarded against. Unless some first-rate men can be at once secured, or another amateur be found to take charge, one of the original party must stay behind to take command himself, and send his friend, with the best auxiliaries available, to conduct the first party of reassurance.

It seems advisable to mention these details, as the natural inclination of men who have been shaken by an accident and by anxiety is to yield to well-meant pressure and leave the 'speeding up' of the often dilatory rescue column to the local hotel-keeper or the first discoverable guide; only concerned themselves, if they are fit, to hasten back with reassurance to their waiting friends. But, of the two, the first is the more urgent duty.

In the event of death and not injury swift action is of less importance. The mountaineer's difficult task is then to get the rest of his crippled party down safely. Peasants of all lands, accustomed to the accidents of life and death, are insensitive to anything but their familiar realism. Their help may be counted upon, but they cannot be expected to show a very understanding sympathy. No later operation should therefore be left to their charge without the supervision of one of the party, or of a friend. The Press may be expected to become for the time an extra burden; its curiosity is better eluded by carefully worded anticipation than left to its own sensational inventiveness. Violent death is savage in its reactions; and manners and taste, which survive only as a thin glaze upon our semi-civilized communities, evaporate at its first rumour.

Although I have thought it right not to exclude entirely some suggestion as to dealing with cases of serious or fatal accident, forty-eight out of fifty mountaineers may, and do, finish their career without ever being actively concerned in one.

Mountain Perversity

Besides the accidents which are produced by the classes of things which at times go away from us, such as holds, balance, or our common sense, there are other less evitable mishaps produced by the classes of things which

at times come at us—stone falls, snow slides, or storms. Mountaineers are too sophisticated any longer to accept a naive statement, that our mishap has been due to one of these causes, as a complete exoneration.

Stones, indeed, form the most convincing excuse. Good mountaineers may use all their discretion to avoid lines where stones fall, but the casual stone, or the stone loosened by human agency, may yet overtake them.

Falling Stones.

A man hit by a stone falling from a height, even if he laughs it off, has nearly always received a greater shock than he realizes. His nerves will be vibrating for a time like strings, and we must be on the look out, especially if we are in exposed places, until we are certain that he is normal again. I have known a man grow faint ten minutes after a stone had struck him and left no apparent mark; and I have seen a guide slip half dazed from his steps a full minute after he had been hit by a spinning stone not the size of a button, which did not even cut through his hat.

But even the peril of irresponsible stone falls can be caged within narrower limits as our experience and our foresight increase. It is itself a small department of our science of reconnoitring to learn how to calculate their probability and recognize their signs. Couloirs and gullies are obvious funnels upon which wandering stones concentrate. In a snow or ice-backed couloir we must study the difference between the ominous furrows made by stones or those made by water. In a rock gully we have to look out not only for stones that may use it as a channel, but for all that its weathering walls may contribute on their own account, or that the changes of temperature, or even the disturbance of our own passage, may dislodge from the balanced accumulations. The surest signs are the absence or presence of stones on the glacier below a couloir, or the grey scars or bruises made by the cannonading stones on the rocks themselves. But these may only indicate stone fall at certain hours of the day. Big grooves in steep precipices and hollows between ribs, where stones may congregate, or featureless flat faces, where they may wander unconfined at their own wild will, are alike suspicious, and the bases of their cliffs must be inspected.

Rock faces, corrugated with very shallow ribs and hollows, are particularly dangerous, as falling stones may ricochet unaccountably across the ribs,—stones harder to foresee and to dodge than direct falls. The edges of glaciers commanded by steep precipices are certain to be stone-shelled. Precipices commanded by glaciers—that is, by the small glaciers hanging high up on great peaks, which are often difficult to locate from below—have also their fixed hours; as soon as the ice feels the sun it begins to discharge its surface stones, and continues until the evening.

But without our own examination we need not condemn any face on general grounds or from hearsay. A number of fine mountain walls in the Alps have been unjustly condemned in their entirety for merely local weaknesses. Others offer salient ribs or lines sheltered by accidents of structure through the heart of suspected zones. Only inspection can say. We may presume steep faces to be more safe than those of easier inclination, because the rock should be sounder, and because chance stones ought to fall outside us if they do fall.

If we have been unfortunate in our reconnoitring, or if we have deliberately tempted fortune too far upon a suspected route, we may on occasion have to put our pride and our progress in our pocket and be content to sit out under a grateful rock screen until evening or shadow has chilled the vehemence of the stone barrage. It is better to risk a night out than persist in tackling a bad line at a bad time. An overhanging rock is a sure refuge. But we are also advised, if ever we see that sunlight is increasing the hostile fire upon some passage that we have to negotiate, to wait until a cloud has frozen up the ammunition sources. As I have never yet lighted upon a stagnant party while they were spending some portion of a climbing day in a pensive examination of the sky for this purpose, I must conclude either that clouds are as perverse as stone falls in the ill-timing of their arrival, or that men are as perverse as both in their pigheaded prosecution of a fair-weather programme.

Besides their customary routes, which we avoid by experience or as the result of examination, there are occasions both of place and time when stones fall un-

accountably. Stones of large mass will fall at night; the melted snow freezes into the cracks, levers the stones from their attachment, and their weight does the rest. Stones, of smaller size but in larger profusion, will fall in the morning, as the sun again melts the ice in the cracks, which has already detached these lighter stones but kept them for the night frozen in position. During these morning hours, therefore, stones must be looked for on rock faces where they need not be expected during the rest of the day.

During all the hours of hot sunlight, slopes of mixed rock and snow, even of easy angle and harmless aspect, may become operative. Rock extruding from ice is generally more disintegrated, and much of its freshly exposed surface, temporarily cemented by frost, is liable to discharge in sunshine. Any slope of ascent which drains a wide stone-shed of such mixed character must be approached with caution.

Again in hot seasons, after snowless winters, whole regions of rock, gradually disintegrated under their normal covering of ice or snow, become exposed; and in such seasons stones must be looked for on the most respectable peaks. Impeccable cliffs, of traditional mountaineering approach, will be cinctured at their base, and not only there, by bands of discharging rock, remote from and disregarding the time-honoured waste-shoots.

Bad weather, rain, and especially wind, will start volleys in unaccountable places at the most inconvenient times. After storm or heavy rain, even secure lower paths may be raked by a dropping fusillade. But such passing exuberances have also their comfortable aspect. The bruises that surprise us by their appearance on sheer hard crag, where no stone had any business to fall, or the intimidating fragments on the glacier below our firm and promising rib, may be merely such a single past morning's effervescence or the excesses of a solitary thunderstorm.

Other surprise stones may be due to the passing of goats or chamois above—a rare case in the Western Alps —or more frequently to the presence of other parties. These are a very definite and constant danger, especially on loose faces like the Matterhorn ascent from Zermatt, where half a century of clumsy climbing seems only to

have augmented the supply of mountain ammunition available for daily use. It can only be avoided by keeping off these routes, or by making sure of starting first. If we succeed in so doing, we must remember our mountain manners. On any route where stones are likely to fall, no party, however expert, has the right to increase the risk for others below by racing ahead. Unless our line takes us well out of range, we must wait, in ascending or descending, before crossing any passages where there is a prospect of our dislodging loose stones, until the party below is temporarily sheltered or near enough to suffer small damage from the event. We may expect the same consideration from our forerunners, or make ourselves clamorously audible until we secure it.

Stones loosened by the party upon itself, by rough grip climbing, by sitting while descending, by a rope carelessly managed, and so on, are matters for the correction of climbing technique, and cannot be rated, either mentally or vocally and emphatically, as risks from external causes.

But there is still always the familiar terror of the single stealthy stone, that shoots out for a solitary venture on the blandest of mixed rock and ice climbs, sliding soundlessly or skipping venomously on a sharp edge. It can only be countered by the warning of an alert leader and by prompt dodging.

The throwing of stones from the tops of peaks or cliffs is happily confined, apart from a few classical recorded cases, to tourists in our own islands. It is not done by mountaineers ; and the method of impressing its serious dangers upon the offenders may be left to the emotional coefficient of the party imperilled to elaborate.

If, in spite of all precautions, a falling stone, or a fall of stones, threatens us, our position at the moment decides our action. In the case of a rock avalanche, whose minatory sound is unmistakable, we shall hear it before we see it ; there is nothing to be done but to crouch and get what cover the rock will afford, especially for the head, without trying to locate it. If it is a single stone, or a few stones, sight and not sound will be giving us the warning (unless the risk is already past), and it is best to wait, with back or side turned towards the stone, and watch over our shoulder. A stone falls surprisingly

slowly to the eye; its course can be followed, and dodged most effectively at the last second, if it is not in any case aimed to miss us. In dodging or taking cover from stones, the rope must not be forgotten. It is little less serious for the rope to be caught by a large stone falling than for one of the party. To run is often more dangerous, for other reasons, than to stand still. Most guides are terrified of falling stones. They are the one risk external and unaccountable which they cannot train themselves to meet, because no skill can foresee them. Some part of their allied dread of bad weather is due to the increased risk of stones it brings: "A terrible sound of stones cast down, or a running that could not be seen of skipping beasts, . . . or a rebounding echo from the hollow mountains, these things made them swoon with fear." The majority of guides will shout and start skipping indiscriminately in panic. Men who do this must be brought sharply to their senses. An effective, if possibly fallacious, argument is to point out that a stone by falling on a particular line has enormously reduced the chance that another will fall on the same line again.

This argument does not apply to the case of stones which converge from wider areas above, to fall through a particular gully or couloir. A mountaineer, if he finds himself in such a conduit, had certainly better get out of it as quickly as may be safely possible.

If it is absolutely necessary to cross a couloir where falling stones may be expected, or heard, it is best for the party to cross singly, unroped. But if crossing unroped involves a more immediate risk than the chance of a stone striking, not more than two men should remain on the same rope together. One man should cross the couloir alone, with plenty of rope loose for a spring forward or backward to safety, while the other anchors under shelter. If there are three men on the rope, the two end men should cross first, each with plenty of rope; the middle man follows last, with the same allowance. This reduces the danger for the middle man. To be caught by stones in a couloir on the middle of a rope held at both ends is to be trapped. There is no time for the man at either end to release his rope, or, even were that possible, to discover towards which side the middle man intends to escape.

On the whole, considering the amount of stones that fall in the Alps, especially on frequented peaks, the amount of stones that are dislodged by inexperienced climbers on one another on our own cliffs, and the amount of recent stones that litter all mountain bases, and that must have fallen some time, it is astonishing how few and how slight have been the injuries they have caused.

Snow slides or avalanches are restricted in summer to more definite danger-zones than are the errant stones.

Snow Slides. But when they come they are less evitable and more overwhelming in action. Snow falls not only according to the accident of its position, which is ascertainable, but also according to the chance of its condition ; and this is susceptible to influences more numerous and more volatile than the comparatively better delimited and more violent forces that produce the loosening and fall of stones.

Again, if we are forced to cross danger-areas of stones or snow, we have the better chance in the case of stones. Each falling stone only occupies in its fall a fraction of the area of danger, and may be eluded ; but every inch of snow in an area of avalanche risk is alike pregnant with danger. It is no longer a question of artful dodging individually, but of an escape in time by the whole party, possibly over a considerable extent of slope, all of it equally treacherous.

But snow makes these concessions to the skilful leader: its presence can be located ; its condition can be tested in advance. Experienced reconnoitring beforehand may advise us to avoid a snow passage altogether: precaution on the spot, a thorough testing of its holding quality, gives us a second chance of eluding an unpleasing surprise. But these safeguards are precautionary rather than corrective, and belong properly to the province of prevention, that is of snow craft.

Correction becomes needful when we have been deceived in our craft, and find ourselves by error, or perhaps by chance, on a risky snow passage. The snow threatens to slide or to avalanche, because it is either powdery and superficially slithery, or water-logged, or crusted and detached below, or bedded deceitfully upon ice. Now, to continue to trough horizontally across suspicious snow is equivalent to sawing through

a high branch, on which you are seated, between yourself and the trunk. We must turn vertically up, or down, or follow as steep a diagonal as we may. We make steps as far as possible apart, and we tread exactly and lightly in each other's. If there is firmer snow below, we drive the axe to the head at each step, and loop the rope. In extreme cases we may turn face inward, as the toe is less disturbing than the heel or side-boot. Or we may have to clear away the snow and make steps in the ice below. All as our craft dictates. On positively dangerous snow there is much to be said for unroping, should we have to continue long in equal insecurity. The rope can be little protection; concerted action once a slide starts is impossible, and if the slide embraces the footing of all the party, the individual chances of survival are greater without it. But while admitting that there is a case for unroping, I have never known a party do it.

If, in spite of all our discretion, the snow slide or avalanche starts, any further chance of corrective action passes out of our hands with the loss of our footing. A good deal has been written about what we ought to do in an avalanche: cut the rope, adopt a swimming attitude, roll sideways and so on. To anyone who has ever bathed in broken surf, or felt the weight of even a thin film of snow sliding about his ankles or on to his shoulders, all such nostrums will seem about as practical as that delightful recommendation that we should all wear a red appendage of trailing string, as a signal to those who search for us in an avalanche. The vision of a line of sturdy mountaineers tripping intricately across a snowfield like embarrassed macaws in pursuit of each other's scarlet tails may give us some pleasurable moments. Possibly coloured air-balloons, to keep the string-tails floating archly above our heads, might add to their picturesque efficacy.

A man in an avalanche can only act by instinct; and he will instinctively struggle. If he keeps, or ends, upon the surface, it will be due to the shallowness of the slide or the depth of his good fortune. It is well to remember that a man, by an accident of compression, may live for some time although overwhelmed and out of sight under the snow; the survivors therefore must take the risk of further snow falling and attempt the rescue work at once. The chances of survival will

always be greater in a slide of powdery snow than in one of wet snow.

Ice falls in fashions more fathomable than snow, over more limited areas and by more discoverable rules.

Ice Fragments.

We may find ourselves forced to pass below *séracs* on glaciers. A *sérac* may fall; but *séracs* are very obvious as well as beautiful, and the really capable eye is at fault if it cannot foretell when one is likely to fall, within an hour or two, and hurry out of its track. Even if it is too far above us for inspection, there is plenty to guide us in the condition of the ice near us and in the feel of the atmosphere. *Séracs* are usually safer than they look; and it is wiser, if we find ourselves unwittingly under fire, to glide out of it quietly and competently than to rush into the real frying-pan of a panicky flight. If there is opportunity, we get rid of the rope; a man on claws, without the rope, has a much better chance of dodging the *sérac* that topples. Heavy step-cutting just below a poised column had better be avoided; but I am half sorry to record that the hallowed myth that it is dangerous to talk or breathe loudly on such passages is not borne out by latter-day *séracs*. I have shouted very loudly and clearly into the ear of a number of very promising ones—of course from safe positions on their shoulders, and not, like Lauener, from their 'dangerous' heads—without eliciting even a nod of response.

Only one other case suggests itself where falling ice might be classed as an external or objective risk; and that more because the extent of its danger-zone is undiscoverable than because its position, or the probability of its fall, is concealed from ordinary foresight. In a snowy season, with alternates of melting sun and freezing wind, the day comes when the rocks of a peak or ridge are armoured with ice plates or ice spears. If we traverse unsuspectingly below such walls, an hour's sunlight may expose us, in the middle of our enjoyment of our postponed fine day, to a raking and dangerous fire. The missiles may come shooting over the edge of any innocent, black jut or buttress far above us. The only course is to watch, and dodge, and make carefully for open country. That what has fallen once cannot fall again in the same place is even more true of these ice plates than of stones. For our mischance, also, we may have to blame ourselves as much as the mountain.

Rocks in such a state generally betray some gleam of their ice armour to a heedful examination, and as the chance of such a condition occurring should have been suggested to us by the kind of weather that produced it, we ought to have been able approximately to locate the peril beforehand, and avoid its zone.

Thunderstorms or blizzards may produce direct catastrophe. Of a blizzard we should have had pre-

Evil Weather.

monitory signs; and if we are caught in it, we must just fight through it, and we may not afterwards justly blame the mountains. It is a foolish pride which thinks to show hardihood by persisting wilfully, among big mountains, against the threat or oncoming of evil weather.

But thunderstorms may take us unawares; and then our only refuge is retreat. Their chief menace lies along the edges of ridges and on outstanding points. If a storm threatens, we must get off the ridges and away from pinnacles as quickly as possible, even if it may mean cutting down an ice slope. Sometimes our first warning may be an electric shock, coming out of a dark and windless silence or through a warm oppression of slow-falling and separate snow-flakes, and thrilling us helplessly from heel to hair. If there is no other sign, and in the heart of the worst storms there is no flash and no thunder, the singing of our axes and the hissing crackle of the discharge from every point of the ridge will give warning that it is well to go elsewhere. We are generally advised to get rid of our axes. If we are on a big peak, this will mean our seeking scanty shelter not very far below the ridge where the storm caught us. Personally, I prefer to keep my axe, and use it to climb well down one of the flanking walls. While we remain on the ridge or near it, all points, including ourselves, are potential conductors, and it is awkward to get far down without an axe. We once came on a whole grove of axes abandoned on a summit. When we saw, later, the angle and the condition of the snow slopes that this party had been driven to descend without their axes, to escape from the storm, we realized what frightening things men can do if they are only frightened enough.

Thunderstorms apart, the perils of bad weather are indirect, and give us time to use precautionary rather than corrective skill. A very strong wind may of course

blow us right out of our steps. I have only seen this actually happen once, to a light-limbed mountaineer, who pitched very neatly on the ice steps ten feet lower down. Ordinarily we cling on as we can, and evade the direct blast by moving on to the other side of a ridge. Wind will also pelt us with stones and icicles in unexpected places, or lacerate our faces with snow particles. But its principal effect is usually upon men's nerves, who get 'rattled' and lose their collective rhythm. Continuous loud noise always interrupts communications, and breeds flurry or confusion. It is worth while taking shelter behind rocks, if only for a minute or two at intervals, to steady the nerves again.

Mist and fog can only harm us if our craft fails. We meet them by compass and the sense of direction. Wind can make a gracious exception to its usual offensiveness, and help us in mist. If we have noted its direction, and have observed that it is a constant and not a gusty or spinning wind, we can keep a straight course by keeping it always on the same cheek. Again, when he is approaching the crest of a ridge or a pass, what mountaineer has not had cause, in mist, or even in sun, to welcome the little rushes or breaths of wind that tell him the edge is near and assure him of his direction? After a weary plough up foggy snow terraces or a harsh struggle on mist-wet rocks, these soughs seem like the mountain, too, sighing with our relief, or like the end of our travail surprising our mournful faces with a kindly but derisive 'pooh!'

Earthquakes are natural perversities outside the sphere of ordinary mountaineering prevision. Among mountains their danger is indirect or subsequent. They injure a number of good rock routes, and after a series of shocks we may expect some grievous deterioration in the condition of rock pinnacles and faces. Large masses will have been precariously loosened, and our ledges will be littered with poised blocks and cranky rubble. The peaks affected may require markedly cautious climbing for some seasons, until time and weather shall have tidied down the surfaces again. Some years ago certain of the Chamonix Aiguilles had to be left unvisited for a time on this account. As to how we should meet the uproar of the eruptive moments, it is difficult to suggest an approved method. A moun-

taineer of reputation relates how an earthquake caught him on the precipitous north face of the Dent du Géant; and how that proud pinnacle rocked so portentously that his feet were flung free, and he only saved himself by swinging perilously, like a pendulum, from his hand-holds. It is reassuring to feel that such exceptional circumstance does generally select the exceptional man, and that it invariably finds him inspired to deal with its crises imaginatively. For upon such natural inspiration it would be difficult to improve by devising any more formal code.

CHAPTER VII

ICE AND SNOW CRAFT

ROCK is the framework of mountains, and for those who discover their enthusiasm or train their activity among our western hills, rock craft must always remain the basis of mountaineering. Many of us would not be dissatisfied if the chances of time and leisure offered us no wider field. For our performance, there is more than a lifetime could hope even to examine between the precipices of our mounting uplands and the descending cliffs of our long sea coasts; and for our æsthetic pleasure, nature, through the medium of a soft and variable atmosphere, shrouds the settled lines of our hills with a delicacy of interrupted and changing colour, and a grave reticence of shadow, sun-break and mist, that leave nothing incomplete for the fulfilment of that sense of power and wonder whose realization gives something of the quality of religion to our feeling for great mountains. These ancient hills are at peace with their neighbours the fields, and rest tranquilly among them; content to contribute with their waters and pasture to the fertility, and with their mists and rocks and seclusion to the holiday pleasure of the land which in youth they were wont to cumber with the fragments of each fiery insurgence, or bury under the white burden of their glacial defeats.

The Age for Glaciers.

In other lands, to modify the harshness and to order the exuberance of younger ranges, whose ambition would yet challenge the stars, nature has still to avail itself of the sterner and more primitive discipline of ice and perpetual snow. With this veil, constant but always renewing, it subdues the barrenness and the aggressive angularity proper to their period of immaturity and change, and preserves for them the aloofness that is at once the protection and the charm of free-growing

childhood. It is a mistake to think of the Alps or the Himalaya as venerable because their heads are white: theirs are all the irrepressible impulse, the uneven humour, the unconscious cruelty and the overflowing vitality of froward but jolly children.

A mountaineer may be satisfied to nurse his athletic infancy upon home rocks, and he may be happy to pass the later years of his experience among the more elusive impressions and more subtle romance of our old and quiet hills. But in the storm years of his strength he should test his powers, learn his craft and earn his triumphs in conflict with the abrupt youth and warlike habit of great glacial ranges.

Snow and ice are permanent upon the high hills, and consequently ice and snow craft are essential departments of greater mountaineering. To treat them as decorative adjuncts, cultivated by a certain set of rather old-fashioned folk, or to say, as I have heard more than one promising climber say in effect, "Rock is good enough for me: snow and ice only mess it up; *I* shan't bother with that sort of Alp!" and then rush off to the Dolomites as a relief from the Fells, is equivalent to refusing to exchange the foil play of practice for the rapier play of real contest with the best champions of the mountain realm: it means the repudiation of the better half of mountain knowledge, and the renunciation of almost all its rewards.

The higher craft of mountaineering begins above the line of perpetual snow. A rock climber who leaves his rocks at that level can never discover even all that rocks may offer of difficulty and variety. The refinements of climbing develop out of the modifications that rock and ice and snow produce in one another. It is among the elastic extensions, the frequent exceptions, which their combination imposes upon our grammar rules for rock or snow, that the mountaineer is evolved out of the climber.

Our strong years are the years in which to learn the complete craft of greater mountaineering. And it is also in these years, while the senses are keen and the imagination undimmed, that the entries and illustrations most worthy of assembling in our book of memory can be collected from among the daring sights and hazardous incidents of high mountaineering as from no other

ROCK AND ICE [SYDNEY SPENCER

region of adventure. Never to have broken too soon with sleep, and issued up on to the grey coldness of night-frozen glaciers; never to have felt rather than seen the loneliness of frosted grey peaks, oppressed with a sanctity of reluctant seclusion; never to have endured the enchantment of solitary space, an intimate but hostile fascination that is found elsewhere only in the desert and among arctic silences; never to have almost heard the strange expectancy that fills great snow fields before dawn with questions never uttered and never answered, and whose insistence is only veiled under a livelier and more visible remoteness at the inquisitive approach of light; never to have watched the night widen and the edges of the world draw closer round, as the peaks begin to darken and the glaciers to pale, and the vague shadows of mystery and of elusive presence shrink and harden into form and line and colour with the nearing of sunrise; and, at the moment when the first rose ray quickens the first high summit and day pours in about us, never to have known the lassitude of odd illusion vanish and the summons to good sunlit action thrill every fibre, from toe to finger-tip, with a rush of human mastery in each stout blow of the axe and each fresh shock of the driving heel;—never to have known something of only this one hour of an alpine morning would have been to have missed the most vivid moments of living, and to have deprived our working and our evening hours of their most faithful comrade memories.

ICE CRAFT

For snow and ice as for rock we study primarily balance,—balance in motion, and above joints flexed as well as straight. The elementary movements and practice are identical. Rock is the substructure of mountains, and ice and snow are its accretions. Similarly, rock climbing is the groundwork of mountaineering technique; and for ice and snow we employ the same principles, availing ourselves of the mechanism of axe and claw and ski so as to render them equally applicable to new conditions of surface and texture.

For balance climbing, footwork is all-essential. On rock, only where angle or unsound texture makes footwork alone insufficient, do we help out with the hands. On ice or snow, only where angle or a texture too soft or too hard denies our feet their assurance, do we supplement them with ice-axe and ice-claw, or to a certain extent with ski. While a man remains a grip climber, he will never make an iceman; and he had better go back and learn first how to climb in balance on rocks, rather than set himself the twofold task of learning balance and axe or claw technique simultaneously and painfully on ice. Most of the early mountaineers learned what footwork they knew upon ice first, and it was therefore very natural that they should in their mountaineering precepts give the larger share of space and attention to elementary movements and exercises in stepping on ice and snow. These movements are now learned more easily and perfectly on rock, sound and unsound, and transferred, when we go to the Alps, to snow and ice, following a more logical and certainly more safe order of study. In recent years I have taken some of the very best of the new generation of 'continuous' rock climbers for their first climbs in the Alps, and have found that their balanced footwork took only a few hours to adapt itself to snow or ice surfaces, skipping all the elementary stages hallowed by tradition. Consequently they could start upon the more recondite

branches of ice and snow craft with a rapid assurance that left the guides frankly interested.

Largely because it was the only type of mountaineering that they really studied as a craft, and consequently could fully enjoy when they mastered it, ice and snow craft came to be considered by many of our predecessors as the only true mountaineering, to the supersession of all other branches.

After the possibilities of rock surface began to be appreciated, and while rock climbing was working through its successive and isolated stages, the swing of the pendulum went all too far the other way. Ice and snow came to be regarded by all except the old alpine school as intrusions upon ascents, to be got over as best one could. Their study was proportionately neglected by guides and amateurs alike, who chose the ribs and rock faces for their routes, and were apt to be bothered if they had to come off them. The lack of any advanced technique became painfully apparent when mountaineering ambition progressed to the point of attempting great new alpine ridges and faces, where a knowledge of ice and snow craft is indispensable. Many a failure and even accident revealed what a large lacuna our rock climbers had been nourishing in their alpine understandings.

During the development of balance climbing, whose basis is footwork upon any angle and any kind of surface, the scale has been steadily readjusting itself. Simultaneously with, or possibly as a result of, the unification of our several climbing methods upon rock, ice and snow into a single technique of balance, has come the new interest in foot-attachments, the popularizing of the use of ice-claws and of ski. While balance in climbing movement was still only rudimentary, it was more comfortable to climb on a material like snow or ice, where the human could make holds and steps of the shape and at the angle that best suited his standing or his 'walking' balance. He preferred this to making a series of awkward bodily adjustments in order to fit himself on to existing accidents in the surface of rock. But as climbers learned to master balance during any movement and in every attitude, and to depend less and less upon the hand, they became naturally alive to the advantage of adopting footgear which secured safer and more continuous progress by adapting the feet to the surface, and saved

them the time and rhythm lost in stopping to alter the surface to suit their feet. Hence the increase in our use of soft soles and scientific nailing, on rock, and the perfecting of ice-claws, which allow our feet to walk on ice at whatever angle we find it, and of ski, which make a royal progress of the most voracious snow.

A man who is a good continuous balance climber should be able, as I have said, to transfer his footwork easily and quickly to snow and ice, and to move safely upon moderate mountains, satisfactorily managing the rope and cutting the occasional steps that such ascents demand. Here many climbers stop learning, even among those who write books; and just about here the real delights of icemanship and snow craft begin faintly to suggest themselves. From this point on our rock technique cannot help us, and may, if persisted in, merely embarrass and delay us. Ice and snow, conjoined or apart, with all their significations of colour, texture and angle, and in their local or ephemeral counter-changes, form a study by themselves. As it is certain that we cannot do much route inventing or advanced climbing upon rock without knowing something of the different sorts of rock and their meanings, so is it far more certain that in really big mountaineering no one will get far or go secure whose knowledge of ice and snow is limited to the mere physical ability to climb upon them.

It is impossible to do more than suggest a few lines which training might follow, in order to attain to a point of experience where the specialized study can be begun.

The Nature of Ice.

To start with, it is as well to know something, sufficient for the working purposes of practical summer mountaineering, as to the different sorts of ice which we meet with in the mountains. There are three principal varieties:

Firstly, '*grainy ice*,' or '*blue ice*' as it is usually called from its colour. This is formed chiefly from snow, by regelation. Nearly all glacier ice is of this character; whence we also know it as '*glacier ice*.' It is glacier ice with which we have by far the most to do in the Alps, and its successive stages have to become familiar to us as names, and recognizable from their appearance, if we ever wish to lead a party. In the first stage pressure makes the fallen grains of snow cohere, and an opaque white mass is thus formed, a fine-grained

solid, containing a lot of imprisoned air. This stage is usually but incorrectly named '*frozen snow.*' Under the further action of pressure these grains coalesce, by regelation, and larger grains are formed; part of the entangled air escapes, the solid becomes coarse-grained and less opaque and assumes a bluish tinge. This is called *névé* (or *firn*). Under the continuation of the process ultimately all the imprisoned air escapes, the solid becomes transparent and very coarse-grained, and its larger masses have a distinctive, blue colour. This is called '*ice.*' As the process is a continuous one, it is impossible to draw a hard-and-fast line between the different stages, or always to be sure of saying with certainty that our feet are on the one or the other.

Secondly, there is '*black ice*'; ice more or less continuous and generally in layers, formed by the freezing of water. This is comparatively rarely encountered in the Alps, or in mountains, but more often in winter than in summer. Where it intrudes, it is very exacting, as it calls for a different type of claw technique and a different sort of blow with the axe.

Thirdly, there is an intermediate, and intermediately attractive and frequent, class of ice, produced by the infiltration of water with snow, and by their subsequent freezing. This is called '*snow ice.*'

In route designing and in climbing we have to be able to recognize these types and stages. Each has its own right method of treatment. But grainy or glacier ice is the characteristic alpine ice, and most of the suggestions made as to ice technique apply to ice of this description, where it is not otherwise expressly stated.

A large, dry glacier introduces us to almost every normal type of ice, from hard blue to *firn*, and is the best practice ground for finding our ice feet and transferring our rock balance to ice angles. A week's good practice devoted exclusively to ice craft on a glacier, under a good mentor, will set our feet on the way of better icemanship than if we trust for our training to the hours of sporadic ice work, generally of some difficulty, which we may meet year after year, and muddle through, on our big climbs. Few men are systematic enough to devote all their first alpine enthusiasm to a restricted training of this kind; but any man who hopes at some date to become a mountaineer should

begin early to give his ice some intensive study. Even a mountaineer of experience has to allow for personal variations when he returns each season. However well attuned he may keep his sense of touch on rock by practice in Britain, he takes some days to recover the feel of his feet on ice, and his ice nerve; very much as a skater or a skier has to do each winter. Some of us make a habit, in theory at least, of giving the first day of a tour to work of all sorts on a dry glacier; the second day to some short climb, combining both rock and snow work; the third, probably an off-day, to going up to a hut, and the fourth to a big climb, which must embrace as much varied ice as possible. But this is for resumptive practice in technique. It is not sufficient for a commencing season, or for a grounding in common ice law.

Ice-Claws.

Any man who wishes to make big ascents is well advised if he begins early to learn how to use ice-claws (or crampons). It is not that we cannot climb without them, even as we could without nails in our boots, but that we can learn to climb more securely, and go faster and farther, with them.

Claws have been used by individuals for something like a century, but the conservatism of mountaineers long refused to recognize them as more than an individual eccentricity. It found itself able to draw a nice distinction between the 'sporting' character of the assistance given by a number of long spikes separately and laboriously screwed and unscrewed on the boot, and that of a similar number of spikes affixed by a single simple mechanism. It was not until the guides finally capitulated that the practice could grow at all general or that its extra security could become recognized as workmanlike. Claws were formerly assumed to be useless unless worn by every member of a party; an assumption that prevented their use by many amateurs who failed to carry their guides' conviction with them. As a fact, even one expert furnished with claws can do much to assist the security and lighten the labour for his clawless party on difficult ice, by preceding them and helping or protecting them with the rope. Let no amateur, therefore, ever be discouraged from taking his own where he expects ice work. He will always be the happier himself, and may on occasions

be able to point a prolonged moral to his party. Up to the present they have still been looked upon as an experiment, and men have been apt to get discouraged if they have taken them out once or twice and had no need for them. Sometimes they have then dropped carrying them; found that they could 'get on all right without them'—as who cannot?—and so begun to exaggerate the labour of their portage and minimize their use. The habit has to be formed. It can become as natural to take them on a big ascent as to carry the axe, spare rope and shoes upon a rock climb.

I must premise, that claws postulate precise footwork. A slovenly habit they cannot correct, and may only confirm.

If we use claws neatly, we need no longer cut steps upon all the easier angles of ice or hard snow. We can walk straight ahead, up, down or along, without check for step-cutting or loss of rhythm. We can take foothold just as is most convenient for our balance as we move. Thus a good balance climber from the first moment gets all the advantage of the footwork he has learned upon rock: the labour of 'finding his feet' upon ice is reduced to a minimum. Again, claws increase our security, if we step accurately, when we are moving upon angles where, for reasons of steepness or other difficulty, steps may still have to be cut. In using slippery steps they permit of a confidence of movement, firm and continuous, similar to that which previous experience will have taught us contributed most to our security upon rock. In so far claws, even while we are learning, make for safer progress.

Their fashion has been fully dealt with, under Equipment. As to the character of claw which may be of greatest service, there exist divergent schools of thought; and each finds justification for its belief in the greater usefulness of its particular claw for some particular type of ice work.

In general, heavy claws are better for a heavy man, light for a light. Ten-point claws are better than eight for a large foot, and six-point claws are hardly worth their weight in carrying. A heavy claw, with long, sharp points, which suffer in contact with rock, is worth its extra weight if some big ice expedition is in prospect. At the same time, a good climber can, if he is prepared for the extra labour and for the more careful technique

which their use requires, accomplish with safety all the ice work to be found on normal climbs with a lighter claw of slightly shorter points. This lighter, rougher type will be more useful to him for mixed ice and rock climbing, as he will be able to sacrifice its shorter and inevitably more blunted points with less regret, while he can retain the claw over every kind of surface. The necessity of constantly putting off and on the long, sharp claws on mixed climbing, to avoid turning their points, has the drawback of losing time, and, still more important, of changing the action of the leg and the feel of the feet. Consequently the rhythm of foot and leg has to adjust itself, after each change, to the new character of surface and movement. Whereas the claw which can be worn all day if the conditions demand it, regardless of rock or blunting surface, and which can be thrown away or resharpened when it has suffered sufficiently, while it may call for more skill and effort for its secure use on long, steep passages of hard ice, possesses the compensating advantage of keeping the action constant, without change to the feel of the feet, to the rhythm, or to the greater or lesser security of the tread.

On the other hand, the finer, heavier claw, by which I mean the claw of the Eckenstein pattern, has the merit of being the only claw at the present time in which both the metal is rightly wrought and the points are shaped and placed under the foot with any scientific regard for their use. It is also the only type which it is safe to wear on hard 'black ice'; which, even if rarely, is occasionally found on big summits in the Alps or on sunless northern faces.

Of course the claw must be made exactly to fit the boot on which it is used, and it must fasten and take off easily and securely.

The theory of the use of the claw, with all the various positions of the feet required, can only be dealt with in a monograph to itself, and this has been already more than adequately done.[1] It is sufficient for the

[1] *Climb. Club Ann.*, 1912. Also, where there is danger of frost-bite to the feet, as in the Himalaya, the risk of a nailed boot is avoided by wearing claws over soft hide boots or strong wrappings. For the same reason it is better to wear warm ski-boots, with removable claws, rather than nailed boots in winter mountaineering in the Alps, where the ski-ing alternates with the climbing and a soft boot would be insufficient.

commencing mountaineer to know that he has to learn how to use claws, and that he cannot do so effectively without preliminary practice. This practice should be on a glacier, and under direction; no man really discovers what the claw will enable him to do until he has seen what confidence and skill can accomplish in the conquest of angle and of natural nerve revulsions. The movements are not entirely natural or self-suggesting, more especially those of descending or of traversing on very steep slopes. The masters of the art can walk, and sustain weights, sideways or straight upon their feet, up to angles of 70 degrees or more. An ordinary climber can learn to move with comfort on angles, of good surface, between 55 and 60 degrees.

When we are on claws, the snow-shuffle and the normal forward swing of the walking foot, heel and toe, have to be forgotten. The foot is lifted rather higher, and is planted cleanly on the ice, without the usual forward scrape. The high, clear lift of the foot must become mechanical, otherwise the points will catch on boot or puttie, and a nasty trip or fall may result. The downward pressure or thrust of the foot varies in force according to the angle and the hardness of the surface. To prevent the points working loose in the holes they make, the foot has to be placed at once in the position and at the angle in which it will have to sustain the weight of the body passing across it. A balance climber who has mastered the tense, dancing action of the foot as it is set upon a rock hold will have to learn little new, except the habit of the higher lift and the more vertical plant.

In ascending, our object is to keep the feet pointing forward and straight as long as the angle will allow us to; only turning the toes outward when we can no longer get the heels down. On most ice it is sufficient if we get hold with two points of the claw alone; and on a fair surface we can walk straight-foot up very steep angles, trusting only to the two points on the toe. Up softer steep surfaces, or literally precipitous angles, we adopt a crab or sideways walk. We descend steep angles with the knees bent and the toes forced down. The ankles have to, and soon do, acquire an increased suppleness and strength in claw practice.

Perhaps the most difficult task for the beginner is

to learn the art of walking and balancing upon flexed ankles, while traversing across steep faces. To strike all the points in neatly and strongly sideways, and with a flexed ankle, so that the flat of the sole may meet the surface cleanly and without a scrape, takes some practice; but slab climbers, who have suppled their ankles by foot-clinging upon steep rock angles, will find themselves a day or two's frog-marching to the good on ice.

Practice alone will bring us confidence in the new adjustments, or allow us to feel as securely in balance above a foot inclined at a high angle, over a bent ankle or a curved leg, as upon a right-angled hold of rock or ice. Once confidence has come, the sense of security in the attachment of the claw to the ice enables a freedom of movement astonishing at first to anyone accustomed only to the feel of the ordinary boot-nails on ice steps.

This additional and confident security, which the claw gives to our foothold, almost eliminates the chances of what are wrongly termed 'accidents' on ice; the breaking foothold, the faultily placed foot, or the slide of the sole on a bad surface as the transference of the weight produces a change in the direction of the leg-thrust. We can balance, therefore, on steep angles far more boldly, and keep our hands free for better purpose. A strong party on claws, in a couloir of uniform surface or on a sound ridge of mixed ice and rock climbing, is often free to do without the rope at all, if it so pleases. The rope is to guard against the results of 'accidents' to individual members; and competent icemen, if they are released from the distraction of the rope, and able to concentrate on their own good progress and safety, have all the less temptation to commit 'accidents.'

Once we have mastered the movements and become confident, we begin to distinguish between varieties of ice, and to vary our claw craft accordingly. For instance, in alpine 'grainy' ice there are three ordinary varieties: hard, soft and rotten. 'Rotten' ice does not lie in the Alps to more than the depth of an inch or two, though it is found of a greater thickness in other continents; when we find it in the Alps, we clear it away with the axe, to leave a firm tread for the claw on the good ice below. Hard and soft grainy ice have their several adjustments, whose differences have to be learned by practice. Hard ice will usually be found

lying at high angles, so steep that we shall sometimes be unable to get more than the hold of a single claw point. Experience alone can make us feel as safe upon the one talon as we have learned to feel upon a single boot-nail on sound rock. For work of this advanced character, for which the heavy, long-pronged claw is better suited, the best practice can be found upon the big fall-ice of dry glaciers. We soon discover, in such practice, that balance is easier when we are confident to move fast, a resuscitated platitude; and that, while moving, we are satisfied with a single point where the whole ten would not have seemed superfluous, had we halted to admire the panorama. But holds, on ice as on rock, are not intended to be held in perpetuity.

The claw is not only useful upon steep ice: on hard repellent snow it spares us the penance of stamping or scraping steps. It is equally reassuring to foothold and nerve on ice-lacquered rocks, or on broken rock surfaces coated with wind-snow or glaze. In a bad season —that is, a season during which snow has been frequently falling, and the rocks are surpliced in various blends and qualities of snow, frozen and refrozen—the claws are often retained for the whole day, and become as natural to the feel of the feet as the more usual boot-nail. It is sometimes even difficult to remember if they are on or off, until they are removed, when the feet become as helpless as they do when skates are first detached. In a snowstorm, for a descent, they should always be put on; and even in clear weather and on good footing it is an immense reassurance to the leader of a tired party ascending or descending a couloir or slope of suspicious or 'mixed' surface, if he can count upon the extra security that claws will give to the deteriorating foot-work of his party.

Again, on those early, fasting, glacier crawls by lamplight, with which most of us are familiar, when we are expected to balance, with cold joints and often without the protection of the rope, along crevasses and walls which may be easy enough by daylight but seem pulsing with danger and dread in the darkness, claws come as a great safeguard; their tactile value is a reassurance to eyes and to feet still leaden with insufficient sleep and superabundant cold.

The evening descent of a glacier, dry or partly snow-

covered, with its crevasse jumping, wearisome for tired legs, and its balance traversing on ice too slippery for jaded feet or day-polished boot-nails, becomes again a delight if it can be taken directly and at a rush, with the new surety of foothold and the change of muscle movement that follow the putting on of our claws. Straight and time-saving lines through glacier falls can then be ventured, even with men dragging heavy sacks or heavy legs, if they have once the new feel of dancing security under their feet.

It is worth while putting claws on even for the short but offensive descent of the snout of a glacier. They crackle crisply down its pebble-pimpled wrinkles and make light gliding of its glassy declivities.

A belated party returning crossly at night down the breakers of a big glacier whose surface has thawed only to be refrozen later to a polished, leg-racking ice-slide, will save temper and re-roping and time if the men stop to put on their claws. Two midnight descents of the Mer de Glace in this condition, without claws, are among the most penetrating and undignified of my remembrances.

On the steep sides of moraines, or on new snow lying on grass, claws, if they happen to have been brought, save much back-sliding. On slippery rock surfaces, such as snow-slimed slate and the like, I have found light claws of constant use.

Finally, we need not take off our claws, if they are light ones, for every rock section of a climb where rock and ice are alternating. On much easy soft rock they are of assistance; and even in steep climbing, if once the novelty of the feel is mastered and the foot has got accustomed to the precautionary tread that protects the points, claws have often a positive value greater than the mere effort we save by not removing them.

To learn how to use claws, however, does not relieve us of the necessity of learning how to make and to walk in ice steps. Nor (although this is a matter of more personal opinion) do claws in my view justify climbers on big expeditions in substituting the small ice-axe recommended by some of the great authorities upon claws, and only intended for making an occasional step or for holding on, for a good step-cutting axe, which has also the potentiality of the third leg on general climbing.

In practice on dry glaciers it is both profitable and

amusing to experiment in manœuvring on exceptional angles, or in walking up between the vertical walls of crevasses. Such practice is good for confidence and for training, and it is even of use to discover how comparatively easy claws make it to get out of crevasses, or similar impasses, without relying on the rescue of the rope alone. A climber on claws, for this reason, can take a measure of liberty in solitary climbing that would be folly for a man without them to allow himself. No doubt, if amateurs were able to keep constantly in practice, and had not each season to stop climbing when they have barely reached their best, they would learn to move with equal freedom on angles of this character at great heights. But as a matter of experience no holiday mountaineer can entirely acquire the same feeling of confidence and security if his ice slopes are subtended by dangerous mountain walls or are situated on exposed tracts. Fatigue, diverse air-pressures and, above all, the psychological effect of height contribute to handicap him in venturing on claws risks which he would laugh at on a twenty-foot wall on a glacier. Consequently we find that most mountaineers on very steep, hard ice at great heights prefer to cut steps to aid their claws. In mountaineering on a big scale we usually begin to feel this need when the angle of the ice approaches anywhere near to our limit of average performance upon claws in glacier practice. It is more our sensation than the angle of the ice slope which forces step-cutting upon us. And there is yet another common occasion for steps. On ice which is covered with snow, where without claws we should clear away the snow and make a step in the ice, it is of course similarly open to us to clear it away and step simply with the claw on the exposed ice. But, as a matter of fact, it is generally the practice in such case to make a nick for the claw. Unless the nick is made, the mass of snow round the clearing prevents the foot from being placed conveniently and from providing a sense of security commensurate with the sensational situation. Thus to secure a good reassuring claw hold we should have to clear away an additional quantity of snow, and we may just as well make a nick-step at once. A step in ice when claws are worn need only be a nick for a proportion of the prongs. It takes less labour and art to fashion than a step for a boot.

Again, ice at great heights is occasionally covered with a rotting coating, or crust, through which the prongs cannot reach to the good surface below. Here clearing the rotten ice will in any case be necessary, and, for the reason given above, it is more comfortable and as quick to cut through it and make a step at once.

Where, also, ice is really hard 'black ice,' it has an iron quality of surface, through which the prongs have to be driven with real force; and they make clean, hard holes from which we have the feeling they might slip out, as if from smooth metal sockets. Without steps, at steep angles, balance on such ice is a very delicate matter, as this is a branch of claw technique in which the Alps give us little practice. The nerve of most men will call for auxiliary steps. But whether steps are made or not, on such ice the rope must always be retained.

For the average man, therefore, it is still needful to know how to fashion and how to walk in ice steps; both for use on the brief intervals of ice and snow on climbs where the amount of difficult rock and the small proportion of ice in prospect have suggested leaving the claws behind, and for occasions, of which some have been mentioned, that arise out of exceptional mountain or personal conditions.

We have then to learn how to cut and use steps on ice, at high angles, in awkward places, or when com-

Cutting Steps. plicated by certain conditions. Claws cover the rest of the ice field.

A man who sets himself to learn how to cut steps well must begin by practising on ice. Theory can only help him to avoid certain false positions. A word from a mentor on the spot will save aching shoulders and blistered hands, and be of far more use than many books. Book-lore has rather hindered than helped us by some of the theory it has set down.

It is natural that amateurs who had the example of golfing and other 'arm-movement' sports on free angles before them should have been attracted by the idea of a step-cutting 'swing.' This has been therefore recommended as a saving of strength and an ideal in style. Possibly many climbers besides myself have formalized their style and retarded their acquisition of ease and security by practising the acrobatic feats of balance which an attempt to swing from the hips in step cutting

necessitates. On ice slopes of an easy angle, where we need no longer cut steps at all if we use claws, the swing may be graceful. But on steep ice the swing from the hips is irreconcilable with a secure balance. The most we can attain to is an interrupted swing or 'follow-through' with the shoulders alone, to ease our pure arm-work. It is not unlikely that the appearance of body movement which this shoulder swing gives to the whole coat of a master iceman, as seen from behind, misled early students of the art, who were following in ice steps, into the belief that they were watching their ideal swing from the hips. But such a swing on steep ice is impossible. The step-cutter is balancing in many cases on one foot, supposing him to be cutting steps at wide 'mountaineering' intervals, or on the downgrade; at best he is on two feet set in the same straight line. He cannot, therefore, risk any swinging movement which would disturb his balance above his single base line or point. Let anyone try the hip swing standing thus on a single foot, or on feet alined at a wide interval on the ground, even without the complication of the narrow ice step or the obstruction of the side wall. He will begin to doubt the advisability of our classic swing. Nor may a step-cutter let his swing travel inward with the axe on to the slope; because it is the essence of good step-cutting that the axe shall stop with a jerk, releasing itself from the 'stick' of the point in the ice while it jars loose the section of ice that it has split. The hip swing, therefore, if we attempt it, must be checked at both its ends; and very little space remains between the two checks to get the swing going. The steeper the ice the shorter the axe-strokes, and the less and less the opportunity of introducing the swing. As a further difficulty, no one but a craftsman trained in the workshops could swing the whole body so exactly as to strike with his point within a fraction of an inch of the spot required. In chopping wood, which is done with the feet spread, an amateur can achieve this; but if he is balancing on feet alined, it is beyond the skill of most experts to swing from the hips, strike absolutely true, and at the same time remain in secure balance.

Even the shorter shoulder swing, which we use on slopes of easier angle, where we can get some support for our balance, when standing on the outside foot, by

pressing the inside foot or the inside knee against the ice wall, becomes impracticable when we are standing, as we must be for half our cutting time, on the inside foot, with the outside foot in a line behind us or swinging free to our poise. On steeper slopes, where we have no margin of balance for any outward swing and no room to get a support for the inside foot against the ice, the shoulder swing becomes impracticable even when we are cutting off the outside foot. On such slopes we are only free to use the short play of the arms, and cutting becomes simply accurate 'chopping.' Not only on these steep angles of ice, but on all awkward passages where we are not placed comfortably for free cutting, but where we have to aim our steps at cramped angles with bent arms or with one hand alone, our cutting can be no more than chopping from the elbow, or sometimes only from the wrist. Since, for men who wear claws, these are the only passages on which much step cutting should be really needed, the body and shoulder swings may be safely dropped out of the category of desirable ideals.

The characteristics of a good cutter are accuracy of aim in making the stroke, with the right inclination of the pick and the right jerk of the point; good balance upon both feet or on one foot; and an easy but restrained arm movement, so that he can continue the strokes with smooth precision for an indefinite time. A man who has acquired these will naturally use any easing of the slope in his favour, or any facilities it may offer him for better foot balance, to lighten his armwork by means of a follow-through with his shoulder. But if a mountaineer begins to learn with the idea that he has to 'swing' in order to cut well, he will expend most of his energy upon easy angles where claws make it unnecessary to cut steps at all, or in recovering his balance and making very bad steps upon steeper slopes—for the short spells that his strength and nerves will stand.

A good step-cutter need not 'swing,' but he also may not 'press.' It is mechanically obvious that if a man is not swinging, but has his stroke under muscular control throughout its duration, he will gain nothing, and merely fight against himself, if he tries to force the stroke or 'press' before he arrests his point with the final jerk. Once the stroke is started, a good cutter lets

the axe fall of its own weight; that is, he follows the stroke through with only just the amount of control needed to direct the point until its contact with the ice.

Each man must discover his own fashion of sketching out a step. The sequence and arrangement of his strokes will vary with the quality of the ice and with his position for cutting.

Every step should slope slightly inward. The angle of the tread is of more importance than the size of the step. On steep ice the inside or back wall just above the step should be cleared away, to allow the shin room and to let the leg stand upright above the foot.

The outside edge of the step should never be cleared entirely or flattened. The ice dust or fragments, if not too large, should be left there, to pack under the foot and give it a further prop inwards. A good step looks like a rough notch before it has been used; but after the first foot has passed over, it should have taken the shape and size of the sole, and look like its mould.

Large steps or 'buckets,' such as the guides provide as the beginner's joy, are useless to men who wear claws, and more dangerous than small steps for those who do not. A large step has a large uneven, or a large smooth floor, upon which the sole is apt to slip about as the weight is transferred. Its suggestion of moral reassurance is a poor compensation for a spoiled balance.

A step should be small, just fitting the foot and gripping the side of the boot; the back wall should just prop the ankle for better balance. It should be comfortable to leave as well as comfortable to step on to. An experienced step-cutter will always prefer to make small steps, not because of the saving of time, but because, on all but exceptional passages, the small, close step gives him a better basis of balance for his next reach-out and cut. Large buckets only become necessary when the angle of the ice wall is so steep that there is no room for the shin and knee to stand upright above the foot. A big slice has then to be cleared away above the step, and this generally involves enlarging the size of the floor of the step, especially if the cutter is not expert.

A man has to learn to cut off either shoulder. He must also be able to cut steps with either hand alone, in order to have his other hand free to take handholds on the exceptionally difficult passages or traverses where

these are found necessary. To aim a step with one hand needs practice. To keep a firm grip on the axe shaft, more especially as this gets iced, makes it important to secure a shaft that is well balanced and easily grasped. It may well have some protuberance or collar which prevents the hand slipping. For the same reason the sling is a sound precaution.[1]

To cut handholds in ice calls for a very fine touch. The best that can be usually formed is no more than a steadying nick, over the edge of which the glove can be hooked. The hand shapes the edge of the nick to the curve of the fingers by pressure, and in the process the glove freezes slightly to the ice. The hand can rarely give more than a balance hold on ice. Security and anchorage must be given by the feet.

Similarly, the hand or rather axe hold that we make by driving in the pick above us, in order to help us over a bad step, is usually inadequate. The pull that comes on the shaft with our weight must always be from a direction different to that in which we drove in the point, and the strain will either loosen the point or lever out the section of ice which the blow has in part detached. To drive in the pick straight and not on a swinging arc, so that it may remain firm at an angle to take the pull of our weight in transference, requires a kind of arm stroke very difficult to make with sufficient force in hard, steep ice.

For men without claws the scrambling method, which some leaders risk to save labour in cutting, of alternating one good ice step with a scratch for the other foot, covered by an axe hold, can only be excused by rare circumstance. It is far better to take the little extra time required for making sound steps under both feet. Men on claws, however, are better able to use handholds and pick holds in ice. Their feet are firm so long as the angle and their nerve allow them to stand upright in balance. All they require is a balance hold, to cover them in starting the next movement ; for so much assistance a hand nick or a driven pick can well be trusted.

The step for the foot which is passing inside and next to the ice slope can, to save time, be made smaller than that for the outside foot. For a good party, without

[1] See "Equipment," p. 93.

claws, the step for the inside foot need only be a nick for the side of the boot, provided always that it is inclined at the right angle. To use such steps it is obviously important that the whole party should follow with the same foot. For men with claws there is no need to make this differentiation. Wherever steps are needed for claws, they may all be made of the same small size—just a sufficient nick to take the side points of either claw.

In cutting on a diagonal uphill, for men without claws, it is better to make the interval between the steps shorter when the rising step is to be made from the inside foot on to the outside foot. In rising from the outside foot on to the inside foot a longer stride can be made in balance, and the interval between steps can be made longer.

In cutting diagonally on the downgrade, the contrary is the case. In dropping from the inside foot on to the outside foot a longer stretch can comfortably be made than from the outside foot on to the inside foot.

In cutting horizontally, a longer stretch can be made from the outside foot on to a step for the inside foot, than vice versa. Trifling distinctions; but a good cutter who remembers them will save the inches on his alternate steps; and many inches saved on long ice slopes mean a number of steps spared and minutes, even hours, economized.

For men without claws, or not very expert, it is better to make steps too near together than too far apart. Safe progress is the best progress. This applies especially to cutting downhill. Until a climber is thoroughly practised in lowering his weight on the bending of a single knee, he will always find one instant of delicate balance in a descending stride; and the longer the interval between steps, the more difficult the balance, until the point comes at which he is reduced to axe scraping, or shuffling himself down the ice leaning against his hand. When he finds either help necessary, the step cutter should be given warning at once that the intervals are too long.

Cutting on the downgrade is usually found more difficult than cutting uphill. At the same time, the securing of the right fashion and inclination of the step is even more important on the downgrade than on the up, since the balance in taking a down-step is more difficult, not only for the cutter but for his following.

The steeper the angle at which steps have to be made downhill, the more awkward becomes the balance; until, in descending at a very steep angle, the cutting has practically to be done with one hand. For this reason, on very steep slopes it is better to cut short descending zigzags of an easier angle, even in narrow couloirs where economy of time and labour would point to a vertical ladder.

Where there is no room for a descending or an ascending zigzag, it is better not to attempt to make steps for the side-length of the foot, but to descend or ascend face inward, cutting with one hand a perpendicular ladder of 'pigeon-holes,' or steps shaped like small church apses, to be used both by the boot-toes and the hands. For men on claws a vertical ladder of nicks, for the fingers and the two front points of the claw, is all that is needed.

In cutting zigzags for men without claws, besides making allowance for the different size and length of step and interval needed for the inside and outside feet, the turning-step at the corner has to be made of different size and shape. It should always be larger in size and semicircular at the back, so that the climber can pivot round in it on his toe, without hitch, until he faces the other way. It is well to provide a good hand-nick or an obvious hold for the pick, conveniently placed above the turning-step.

Steps upon hard, overhanging ice, or upon ice near the perpendicular, are practically impossible to make or use with any real security. The chief difficulty is to make any sound hold for the hands, such as may keep the body in balance above the feet. It is also generally impracticable upon perpendicular or overhanging ice to cut away sufficient ice in the slope at the back of the step to allow the leg to stand erect above the foot, especially if the tread is slanted downward and inward at a safe inclination. When *tours de force* of this character are performed, it is usually upon ice which has frozen in 'waterfall' fashion, coat over coat, so that it becomes possible to cut through one coat and get a downward handhold between the strata of ice. Such holds, of course, cannot be reckoned upon as dependable for more than a balance lift with the hand. Claws will help us for such nice feats; but they are best only attempted on practice glaciers, or where the rest of the party is soundly anchored.

On high exposed ridges we have often to deal, in traversing across the faces of towers, with a mixed coating of snow and ice, in reality a snow cake in process of transformation into ice by infiltration. The snow has to be cleared away, and enough ice hacked from the rock to leave us on the lower sill of the gap, so formed, a sufficiently firm and broad ice edge for a step. This is fine engraving for a leader: if he cuts too roughly, the whole plate may flake off and leave him smooth, vertical rock to traverse; and if he stops too soon, the flake below may similarly peel away when his weight comes on the step formed by its upper edge.

On glacier ice, any rib, crack or flaw in the ice will naturally suggest itself as the groundwork of, if not the substitute for, an ice step. A stone on the ice, or the pocket which it leaves when cleared away, makes generally an adequate toehold,—certainly a hold for the point of a claw.

In cutting across ice flakes, or along narrow bridges through *séracs*, if the bridge is solid enough it is best to make side-foot nicks along one side of the crest. If it is not solid enough and the steps have to be made along the actual edge of crest, it is well to remember that the fit, and especially the exact length of the step, are very important. The boot sole slips about on the top of a flat ice surface, and a step on a narrow crest which is made too short or too long for the boot renders the balance precarious. If claws are worn, the steps will be unnecessary, and the party will use the side or truncated crest of the bridge according to its solidarity and their own convenience.

On glaciers, the flaking ice that we meet with on the faces of big *séracs* demands great nicety of touch. The steps are difficult to make, as it is difficult to check the fracture at the right point. They are difficult to use, because our weight may continue the work, and the whole flake surface below our feet may come away. Claws are of real service, as they grip without starting a line of downward fracture. If we are without them, a deep pick hold must be secured, driven through into a deeper stratum of ice, to protect the precarious foothold on the flake surface or edge. Large flakes that boom or sound hollow to the axe are best left alone.

On 'crusted' snow, snow that has melted and re-

frozen to an icy surface, which is often too hard to permit of footholds being kicked, steps are best made by a dragging stroke with one corner of the adze-blade along the face of the snow. Any attempt to swing or to cut with the pick will result in the point sticking at every stroke, and thus in very slow progress. On very hard, sticky surfaces, where the pick sticks monotonously and does not split the snow-ice, and where the drag stroke of the adze-blade will not penetrate, the corner of the adze should be struck lightly in, and the axe shaft levered sharply in the direction away from the step-maker. This will burst out a small cube of ice behind the blade. Two such blows and jerks are generally enough to clear a sufficiently long step for a boot. On softer, sticky surfaces a single well-aimed jerking blow of this sort, made by a single motion of the one hand, followed by a sharp, driving kick with the boot, usually forms steps rapidly enough to allow of the maintenance of a slow walking rhythm. Of course, to a party on claws, such surfaces, which cannot lie at very steep angles, present a pleasant ballroom or billiard-table vista of indulgent promenade.

Using Steps.

We learn to use steps before we are, usually, allowed to make them. But we cannot use them until they are made. Hence the order I have followed here.

To use steps rightly calls primarily for good balance. A man must learn to walk in steps upright, merely resting his hand or axe point against the ice as he moves up or down from one step to the other. If he leans inward, or hangs on to axe or handhold, he becomes a danger to his party. The steps are not cut for the angle which his foot then makes with the ice; he may easily slip, and the faintest jerk of the rope will snatch his foot from the step. A man upright and balanced on his foothold at the right angle can take a considerable weight or jerk, if he has but a second's warning. A man on claws has double this power.

In using a step a climber has not only a duty to his own balance movement, but to every following member of the party. He must use it exactly as it is made, and leave it as he found it. The foot must arrive neatly and leave cleanly. A fractional mistread leaves for the next man an uncertain or blurred step, if it does not

ruin its security. There may be no overtreading, and no twisting or turning of the foot on any step, except on the turning-steps which are designed for that purpose.

At the turning-step of a zigzag the climber twists round face inward on his toes. If the step is only cut for one foot, he must only use it with the one foot, pointing it in the direction in which the imprint indicates that the leader used it. Otherwise he will spoil the step and get the sequence of his feet wrong.

On steep ice our main difficulty is to pass the inside foot from behind to in front, between our outside foot on its step and the ice wall. Beginners and bad ice-men are inclined to avoid this difficulty by shuffling from step to step with the outside foot always leading, protecting each change of foot with an axe hold. This is dangerous and ruinous to the steps. On the very rare passages where it may be found necessary,—for instance, on the few feet of traverse across the face of an ice-glazed rock wall, or across a vertical ice bulge in a couloir, where passing the foot is impossible,—the leader will have cut a continuous ledge, on which he intends the feet to be thus shuffled and without risk. Otherwise the inside foot must always be passed in front, whatever the difficulty; and the better a man balances and the less he leans inward and clings to the slope, the easier becomes the passing of the foot. Where the wall is so steep that to pass the leg and hip-bone means really a movement out of balance, the leader may be trusted to have made some handhold above, if only for his own protection.

On steep ice, men on claws have to be very careful in passing the inside foot, so as not to catch the prongs in the puttie or fastenings of the firm foot. On the other hand a man on claws, secured to the ice by his prongs and not merely by the friction of his sole, can flex his firm ankle far more freely outward and allow his inside foot room to pass.

In descending a very steep ice staircase, it is important not only to follow with the proper feet but to notice how the leader used the steps. Steps on a descending ladder are not infrequently cut with the intention that the inside foot should be dropped *behind* the outside foot as we stand sideways on a slope, and not passed in front of the standing outside foot and

then dropped, as in the more usual movement for easier angles of descent. Step cutters should remember the device. It is not only easier, on occasion, to cut a step in this fashion vertically below and not on a descending diagonal, but it is mechanically an easier movement of descent, on a steep wall, to lower the inside foot thus behind the standing foot than to pass it in front.

On a diagonal descent, if the shorter legs of a following man find the steps are made too far apart for his descending balance, and he has no time to make fresh ones, he will sometimes find it safer to turn right round and descend the steps backwards, turning his other cheek to the wall. His outstretched toe can reach farther in this attitude. It is not sound for more than a few steps, and not dignified; but dignity must be sacrificed to security if the steps are already made and it is too late to protest, and it is better to arrive cleanly with the toe on a step, even the wrong way round, than to scrabble down insecurely, leaning against the ice with thigh or hand.

It is often asserted to be the business of the second man to 'finish off' the leader's steps and enlarge them. This has grown out of the mistaken belief that large steps are safer than small, well-shaped ones. The bettering may, on occasion, be done by deliberate arrangement between two men. A return by the same route may be intended, when the larger steps will endure better through the heat of the day. Or if there are weaker icemen in the party it may save time to divide the labour of making the specially good and numerous steps they need. Otherwise the alteration is quite unjustifiable and improper. The best cutter presumably is leading, and he will have made the step of the right shape to start with. If it has been good enough for him to stand upon and cut ahead from, up or down, it is good enough for the party to follow upon. A second working-over of the step risks spoiling it. A patched step is never as good as a clean step, cut just to the right point and left raw for the kick of the foot to finish and to mould. If he does not spoil it, a second man by recutting postpones his real business, which is to emphasize the mould of the step still further by the right planting of his foot. If he has time to spare from his functions of anchoring the leader or the men behind, he can employ

his hands better elsewhere. He may make additional handholds for balance on bad passages, or, by arrangement with the leader, introduce intervening steps, to save the leader time and to favour a weaker following. If he introduces steps, he must be careful not to upset the sequence of feet for which the leader is cutting the main line of steps. He may, also by arrangement, devote himself to breaking up and dispersing any large fragments of ice left about the steps, though not, of course, to clearing out the small stuff which is expressly left to take the imprint of the foot. He thus incidentally relieves his party's bottled-up emotions by offering a fair target for the abuse from below which follows such clearing up, but from which the leading step-cutter must always be exempt. It is a graceful concession on a leading step-cutter's part if, when he is doing his own clearing as well as cutting, he recollects that his following have heads as well as feet.

Men following on claws, in steps, nicks, or only claw-tracks, are freer to vary their sequence of feet or their fashion of using steps; the good hold of the prongs is more than a substitute for the nice fit of the correct foot to the mould of a step. But both for retention of rhythm and for security it is better as a rule to follow the leader's tracks and save the time which must be spent in selecting new treads. This applies more especially to exposed hard ice where the rope is retained. Men moving without the rope may prefer to digress from the actual treads and find unbroken holding surface for their own claws. The leader's general line should, however, be followed.

The Rope on Ice.

On ice, if the rope is retained, as it will be on exacting slopes by all parties without claws and by many parties with claws, it is worn in its normal fashion, with the waist-knot under the left shoulder and on the side towards or away from the slope according to the direction of the zigzag. One hand, generally the right, holds a short length of slack, as a precaution against jerk and to leave a margin for a longer or shorter stride in our own or our front man's advance. The rope should never be quite taut. If both hands are required for a moment, to use the axe or to take a handhold, and the slack has for the time

to be dropped, we must regulate our distance carefully, step by step, from the man in front, so that the rope to him continues to hang in an easy curve, which will neither catch on the ice nor be jerked by an extra length of stride on his part. We expect the same care from the man behind us.

On hard grainy ice it is useless to attempt to belay the rope with the axe, as is possible on snow where the rope can be looped round the driven shaft. Corrective measures must be left to the firm balance on a good step or on fast claws, and to the spring that the arm, holding the slack, may be able to give to the rope before the jerk of a man sliding comes upon our waist. If a man slips, our natural inclination to lean inwards towards the slope and get some clamp with the axe or hand must at all costs be unlearned and avoided. Once the body is no longer in balance, nor weighing upon the steps, the feet are easily snatched from their hold.

On soft grainy ice it is sometimes possible to make a belay by striking in the pick at a sharp downward inclination above us, and looping the rope round the pick and close to the ice. The shaft must then be held rigid in its first position. Unless the footholds are exceptionally bad, this anchor is not more secure than that given by good balance on the feet alone. And men are very apt, when a friend slips, to throw their own weight inward upon the shaft in a clutch of security, thus pulling the shaft down and loosening the pick from the one angle at which it could have been of any service as a belay.

On zigzags it is of no use trying to keep at even distances on the rope, no matter how even the pace. The intervals must alter as the men pass to and fro on the bends. The rope has to be taken in, as slack in the hand, and again paid out, as we cross below or above our front man on zigzags ascending or descending. The turning-step is usually made face inward in ascending and face outward in descending, though occasionally it is safer to make it face inward on a descent also. The face-inward turn has two advantages: one, that we make the turn on the toes and not on the heels; and two, that if we are using a pick hold at the turn or balancing with our axe touching the ice, we have not to make either the change of hand on the shaft of a fixed

axe, or the awkward swirl round of the whole axe outside us and back again on to the ice, which a face-outward turn demands. During either turn the rope should be held high, and clear of the feet.

Balance is always easier when moving in steps at a fair pace; and steps of stationary comfort for turning or special anchoring, and large enough for both feet, are only made at intervals, generally at the end of the zag. Consequently it is not always best to follow step for step with the step-cutter's necessarily slower progress. If we do so, we are constantly having to wait standing on one foot, or with our legs straddled apart on two steps. It is better to pause in the turning-steps and make up time on the series between them. For example, the second man secures his leader from a turning-step, and can wait until his rope is nearly out. He then follows more rapidly up or down the staircase. He gathers up the rope as he goes if his leader is still cutting, or, on worse passages, the leader takes it in as the second ascends. His natural halts will be at the turning-step of a zag or at his leader's last anchor step. This method is of particular use when, as often in a couloir, it is safer and more comfortable to make our longer pauses under the rocks at the sides, and not all to move harmonically in criss-cross up the centre. Men on claws may prefer to be without the rope in such places; in this case they make their advance when they please, and are free to halt on any more comfortable nicks to allow for the leader's slower advance.

For continuous following up steps, the rope and axe are usually held together in the outside hand, the inside hand being left free to take balance touches against the ice or to take in the slack. For slower movement, advancing one at a time, the axe is used for the touches or for resting against the ice during the pause on each step; this saves the chill to the fingers. The axe is at these times held across the body with both hands, the outer of the two hands also holding the slack of the rope.

On very steep or otherwise dangerous ice we shall only be moving one at a time. In this case the leader cuts a large anchor step to which he brings up his second; and the halts will be made by the party only at the recurring large steps. If the ice, and party, are sound

enough for continuous progress, we shall generally be pausing on steps made only for the one foot: it is clearly of advantage, at such times, to have the freedom which claws allow us—especially if we are unroped—to move on until we have found a really comfortable nick to wait upon.

On traverses or zigzags, unless we can reach a very good turning or anchor step from which to pull in the rope of the man following, we do better to divide our stance between two steps. Our feet are then well planted to resist a pull coming diagonally or from straight behind us. On a traverse, if we are facing forward, standing either on one or two steps, it is best not to turn and watch the man following, which will prejudice our balance, but to trust to the feel of the rope to tell us what is happening. The rope on ice with its smooth movement is even a surer telegraph than on rock. Moreover, in the event of a slip behind us, we have not only the sound of the slide as warning, but the time taken by a slide down ice, perceptibly longer than by a fall over rock, gives us extra seconds to brace at our strongest. We are more prepared to do this if we keep our body and head turned in the same direction as our feet, than if we first turn round and then have to recover the best holding position.

Glacier Work.

On glaciers, besides the task of making and using steps, there is the more serious mountaineering business of finding the best route, up or down, or even any route at all. The climber may or may not have been able to help himself by preliminary reconnoitring. If not, and he finds himself upon an unknown glacier, he has one or two general principles to keep in mind.

The shady side of the glacier—there is usually one more sheltered from the sun—may offer the best chance of finding closed-up crevasses: or of discovering bridges, connecting flakes, etc., such as may help him through any system of open crevasses which extends right across the glacier.

On a curving glacier, the concave side may present to the eye the steeper and more threatening waves of surface ice, since the retardation will be greater on this side. Actually, the ice on this concave side, of slower movement, will be less intricate and the crevasses

more contracted. Often the steep crests of ice will be merely surface survivals of crevasses, and their bases will be merged continuously in one another, forming broad glacier dimples easy to negotiate.

On the convex side, the ice crests of swifter movement may appear to be more negotiable, but the crevasses will be open and deep; and on this side there is always more possibility of finding a secondary or tertiary system of edge-crevasses intruding upon the normal side-system. These crevasses are produced by the friction of the glacier against its containing walls, and, like other crevasses, by the unevenness of the rock bed; but being on the convex curve and unsubjected to compression they not only open but stay open. Most edge-crevasses are usually much covered with moraine and stones, on lower glacier, and by many treacherous forms of rotting snow on upper glacier, and they are thoroughly unpleasant to work through. It is best to avoid them by turning out towards the middle of the glacier, until the side-rifts run out in harmless cracks.

On a glacier of approximately straight descent the ordinary systems of crevasses are three in number: these various marginal crevasses, transverse crevasses, and crevasses running lengthways down the fall.

The transverse crevasses are caused by the falls in the rock bed of the descending glacier. They are best crossed on a direct line of ascent or descent of the glacier. According as the glacier is humped in the middle, or flat and even hollow, these crevasses will be found, in the first case, less open nearer the sides of the glacier, and in the second, less open towards the flat or concave centre.

The third system, of lengthways crevasses, is due to the opening out of the containing walls of rock, or to long 'hog-back' elevations in the rock bed below, which thrust up the centre of the glacier. This is the more dangerous system to negotiate. Crevasses, especially those whose edges are concealed, must be approached, for crossing, at right angles to their run. A party ascending or descending the glacier lengthways will have constantly to be swinging its whole length on the rope, wheeling until at least two of the party at a time will be approaching the crevasse at right angles to its

line and their former line of march. So long as the glacier is clear of snow, the crossings can be thus safely, if tiresomely, managed ; but when the crevasses are snow-covered, or where we meet lengthways and transverse crevasses interlinked, it calls for fine iceman-ship to prevent sometimes all the party finding themselves moving along the same line as the crevasse they intend to cross, or even over its snow-covered length.

Where a glacier, straight or crooked, has one of its sides unsupported by a rock wall, and is therefore falling away at its own edge, or where its marginal and trans-verse crevasses have joined hands, a disagreeable system of curving crevasses must be expected. This is difficult to prospect, and dangerous to unravel if it is under snow. To locate the direction of a 'scimitar' crevasse at one point, and avoid it or cross it correctly, does not protect us against its later loop of unexpected trespass upon our route. The side of the falling away of a glacier should as far as possible be avoided, in spite of the temptation of its easier-looking surface ice.

On large glaciers, where two systems of big crevasses, each equal and still active, have met, we find the worst problem of all : that is, separate 'cubes' or islands of ice with crevasses on all their four sides. It leads only to disappointment to attempt to get through a big system of this character. Fortunately it is gener-ally recognizable from a distance by its upstanding squared summits. For a space, also, round the junction of any two glaciers these turbulent effects of cross-pressure must be expected, and the area entered with caution.

On high snow-covered glacier, the huge rotund depres-sions or mills cannot be disregarded. But they can usually be skirted closely with confidence. They are the result of strains that, fortunately, do not create sub-sidiary or flanking clefts. They resemble mammoth ice sea urchins, not glacial star-fish.

On glaciers of rapidly changing angle and surface, a disagreeable phenomenon is the formation of an upper crust of ice, or frozen snow, over lesser depressions of the mill type. The crust gets separated from the fall of the surface below it, and while it continues to present a harmless appearance to all but very close inspection, it may surprise a whole party by letting them down simultaneously into a sufficiently startling hollow. The

situation is generally more sensational than serious. Similarly, in winter, pools are formed in glacier hollows and frozen over. Then they are covered with snow, and the water drains from under the crust. Thus ice-traps are formed very difficult to detect by the eye, but which sound hollow under the testing tap of the axe point. On covered glacier the axe may never rest idle.

Glaciers in general, like rivers, alternate between distinct falls and more level slopes of smooth shoot or broken rapid. The routes through the smooth sections are easy to trace out from above, more difficult from below. The falls are more difficult to unravel from above, on a descent. In coming down large dry glaciers we can assume that a fall rarely extends equally broken right across the glacier ; and that there will be a long bending eddy of smoother surface dallying close round the edge of the more broken section, which may afford us a passage through or round the rapids. On a small or steep glacier, where the fall visibly occupies the whole breadth of the glacier, and there is no eddy round it, it is useful first to discover if there may not be a direct central line which appears to force through the fall a long arrow-point of lazier, more level flow, such as we look for when we are canoeing down rapids. Failing either of these, on a small steep glacier the fall is often best skirted on the concave, or on the shadowed side of the glacier. Only in rare years, of hot seasons following mild winters, do alpine crevasses, or more often one great crevasse, sometimes extend right across a narrow steep glacier, and offer no through route, or bridge. As a last resort then it may be necessary to take to the rocks at the side of the glacier and circumvent the fall.

To get off a glacier at the right point in the evening, and also to lose no time and patience when we turn down on to the big glaciers in the early morning, it is our business to have noted beforehand from above the lie of the crevasses, and the points where it will be best to start crossing their trend. Many glaciers tempt us with long sloping lines of good going where their crevasses slant inward and upward from the margin. If we follow these without pre-examination, we either find our entry carried out and across to where the systems

meet and produce difficult ice, or our exit balked of a landing-place. A few resolute traverses of the side crevasses, based upon observation, will often take us on to the master-diagonal, that launches us clear of the central fall or lands us on our chosen marge.

It will be seen that it is of value to train the eye to read a glacier from above, and mark out the best route, before we descend upon it. This inspection should be made not only of the glacier on to which immediate descent is intended, but of all the glaciers commanded by the ridges upon which we are climbing in a given season. The information may be invaluable for a future day, and the practice will serve conveniently to develop glacier prescience and glacier instinct. In addition, we secure a general idea of the condition of the glaciers in a particular season, or in a particular locality, which will assist by analogy to the unravelling of other glaciers which we may have been unable to prospect. A good iceman not only notes from afar, but retains his recollection of the route he noted when he is actually on the glacier and exposed to the constant temptation of following lines of deceptive least resistance. A number of mountaineers learn to observe, but few to remember; and fewer still will uphold memory against the evidence of the moment.

Conversely, it is valuable practical training to note, when we are on a glacier, the character of its rock walls, and the points at which the ice could be reached on a descent of the last rocks from the surrounding peaks. The rock wall just above a glacier is like a sea cliff, smoothed below, and presents a perpetual problem, of ascent or descent. Long returns may often be avoided by our recollection of inspections of a particular wall, or by deductions from our memory of the fashion of rock finishes found on the local glaciers.

Glaciers vary from year to year, and change slightly from week to week, and even on familiar ground it is wise to keep ourselves up to date by using all points of observation for the rediscovery of their annual or local variations.

With a few general principles as guide, the instinct that comes with experience as our aid, and backed by the usual allowance of climbers' luck, there may be said to be scarcely a glacier, in the Alps at least, which cannot be

traversed by patience and skill in all but exceptional seasons. An additional measure of precaution must of course be conceded, if we are following a line after noon or after sunshine which we could take on trust in the frozen hours before sunrise. And even before sunrise, in negotiating steep glaciers, dry or snow-covered, a very careful eye has to be kept upon the chance of ice avalanches or of the fall of a *sérac*. For this risk is not confined to the afternoon hours, when they are most likely to fall. A warm night, or frost, tepid wind or rain, will put the last touch to the career of many vagabond pinnacles depraved by the sun of previous days.

Where we can command the distant glacier above us, it is not difficult to mark the dangerous pinnacles and *séracs*, and to calculate their direction of fall should they choose for it our moment of passage. Otherwise, if we are launched in the morning, without prospect, into the blind intricacies of a big ice fall, the traces of previous falls must be our signals. They will be either scars, from which we draw conclusions according to their appearance of age or newness, or, more frequently, the remains themselves of a past fall, shattered fragments of ice. From the surface of the blocks we know whether the fall was recent or not. If the surface is blue and new in the morning, it has been a recent or night fall, and another may be expected; the same if it has only the rime of frost upon it. If the surface has melted at all and been refrozen since the fall, it is the fall of the day before or of still older date, and it need not be especially regarded in making an early morning traverse. The differences are notable, and a practised eye, backed by knowledge of the weather immediately preceding, can say within a day or a night when the fall took place, and whether it was a day or a night fall, and judge accordingly, with some probability of correctness, when a similar fall may be expected. Again, if there are traces of several falls of different dates, the passage is exposed to the raking of more than one periodic *sérac* mass, and it must be avoided. If it is but a single old fall, of a complete *sérac*, which no expert will have difficulty in discovering, it cannot fall again and may be disregarded.

After the sun has once risen, all commanding and

large *séracs*, even if there is no trace of previous falls, must become objects of suspicion, if we have to pass below them. Their period of decline and fall is proceeding, and its close cannot be calculated nearer than within a few hours.

But a skilled party, with claws and experience, need not be afraid of adventuring on to a crossing of the wettest, bluest, and nastiest-looking *séracs*, provided that they can work out a route of safe footing and that the threatened zones are visible, and therefore avoidable. So long as snow does not conceal the cleavages or muffle the frailties, the difficulties of ice, as such, are a delight to master. With a good axe, good claws and a good friend, to set one's feet on the crisp spring of morning ice and feel battle joined with the white, blue and silver giants of a glacier fall, I know no excitement so sanely joyous; and no sound so thrilling as the clean hollow smack of the axe and the bell-like rustle of the falling ice-chips returning from the deep crevasse; and yet again, no exultation more healthy than to look back through the glittering labyrinth of turquoise and grey precipice, of sapphire chasm, fretted spire, and lucent arch, flake and buttress, and see the little serpent of our blurred blue steps, edged with the tiny winking prisms of sunlit ice-dust, soaring, dipping, circling, hazarding on its absurd adventure: surely a connected thread of very happy human purpose, asserting its gay consequence triumphantly through the heart of the wildest and most beautiful of the conflicts between nature's silent armies.[1]

Snow-covered Glacier.

Higher glaciers, and the higher reaches of glaciers covered with snow, are the most complex of all mountain problems, and their unravelling is the final test of mountaineering. They demand for their duality of difficulty the mastery of snow and ice technique in combination; and for their associated risk a fourfold measure of precautionary skill; for on them we expect to encounter the ordinary risks of snow superimposed upon the hidden, and therefore magnified, possibilities of danger on ice. The great ice-men, those who can disregard a late descent after a long day, and by memory, or by the ice instinct which is the emanation of recollected experience, are able to lead a tired party unerringly through the fantastic, often invisible entanglements of a snow-covered glacier system,

intensified by sunshine, their own faculties unimpaired by darkness, fatigue or danger, are masters of the craft; and they are few enough for us to give them ungrudgingly the title of genius.

The peculiar risks of snow glaciers force upon us a reconsideration of the numbers proper for a party.

Solitary climbing is never justifiable on any type of expedition which involves either snow or ice; in fact anywhere where the increase in the so-called objective risk makes it impossible to observe the super-precautionary conditions which must always limit a lonely climber's performance,—as elsewhere enumerated.[1] An expert on claws may pass a day alone on a dry glacier, with the knowledge that he is taking some definite risk. But anyone who ventures alone on snow-covered glacier, whatever his skill, is giving to everybody, except himself, a proof that he lacks the most important part of a mountaineer's mental equipment.

The question as it affects a single climber is simple. With the consideration of the justifiability of a party of two venturing on snow-covered glaciers, the complications begin. A party of two, I have said elsewhere, if they are experts, is the ideal party for most rock climbing. For most normal mountaineering which includes straightforward ice work the addition of a third to a strong party adds little except a moral security, and diminishes the complete harmony in rhythm and pace. On clear ice slopes the additional protection is small. If, as between two men, one has not been able to check the other's fall, the third man will very rarely be able to stop the slip of both the others. On snow slopes, except to share the mechanical labour or in certain exceptional cases, already mentioned, to participate in the corrective anchoring, two good mountaineers should not need reinforcement. But on snow-covered glacier, where hidden crevasses come into question, not only are two insufficient but even three may find themselves hard put to it if two of them have to pull out the third from a bad crevasse.

Some mountaineers have maintained, and in print, that it is never necessary to fall into crevasses; that in every case a man with good eyesight, knowledge of glacier signs and unfailing observation (all of which the leader

[1] See "Rock Climbing," p. 151.

of a party of two must possess for *any* type of climbing) can always distinguish their unseen presence and locate their line. This view is nearer the truth than the large number of climbers who have never learned or never cared to use and train their senses would be prepared to admit. In nine cases out of ten the crevasse is really perceptible. But there is the tenth case, with which all men who climb must on occasion have to deal, where there has been no visible sign, and where the crevasse is discovered too late or is only escaped by accident. And further, there is also the supernumerary case when the crevasse *is* visible, but when its crossing must yet be risked, as the milder of several critical alternatives, and the consequences accepted.

As the matter must still be considered one for discussion, and it is of real moment to clear the ground for a sounder tradition than at present regulates our diverse doctrine and chameleon practice, I shall mention a few instances of what I have called the tenth case.

In a recent alpine season a mild winter and a long hot summer produced conditions of snow sub-surface entirely unfamiliar. Crevasses had opened below long-established snow slopes of unimpeachable aspect. Their coverings had become tenuous and fragile, but until mid-August the upper surface of old snow presented no appearance of subsidence or change. No eyesight could have prevented the falls that resulted. Such a state of snow cannot be unique, or confined to the Alps; and, in fact, the same phenomena, in a less subtle form, may entrap less experienced mountaineers almost any season—guides as well as guideless amateurs. Moreover, even where the crevasse shadow would normally be visible, failing light may trick the best eye, a level sun may dazzle, or low mist may wipe out all sign; and then our expert may go through as easily as another. Few even of the most experienced guides but have suffered the experience. Some have been through; others have had their following drop through where they had passed unsuspecting; yet others have only averted the break by good luck or corrective gymnastics.

Again, there is the case when the presence of the crevasse may be visible or suspected, but where its breadth is undiscoverable.[1] Or, again, where the bounds are dis-

[1] See "Norway," p. 546.

coverable, but where their criss-crossing may elaborate new risks. Suppose us to be two grave men making the descent of a hanging glacier. We find ourselves faced with the alternatives of returning up the peak, of sitting out possibly in deteriorating weather, or of taking the chance of unravelling one of those glacier cross-systems of spouting volcanoes, where the ice is heaped and beaten up into snow-covered vault and dome, and only the tinkle below our feet warns us that we are walking over the brittle cupola of some hidden St. Paul's. One of us might be pardoned for breaking through here : and how shall one other extricate him ?

A more frequent, ' supernumerary ' case is that of the bergschrund, with its single bridge which we have to cross to get at our peak at all, or to get home before night. In the morning it may have been secure ; on our return its security, or the reverse, has to be rediscovered *ambulando*. The experience is common enough, and few parties of two will be able to plead not guilty to having at some time taken the flying chance.

In these and similar cases precautionary and corrective icemanship can do much to reduce the risk for the party of two. But unless such a party climbs so as never to cross snow-covered crevasses at all, which is to postulate absurdity, some risk there must always be of a break-through. And if that once occurs, for a party of two the situation is ten times as serious as for any greater number. For if the fact that a man may excusably fall through may be considered established,—and I shall assume that it is, sufficiently at all events for practical mountaineers,—it is only a question of further fortune whether the crevasse is so shaped that one of the party of only two can rescue himself or even be helped materially by the second man. Several corrective devices have been suggested, such as wearing two ropes, keeping a hand-loop ready near our hand on the rope, etc.—devices which are now used in the confidence that they form a genuine safeguard. The intention of the double rope is that if one man falls through, the other will untie one rope from his waist, and fasten it to his axe, which he will drive in securely as a belay. The man below will then pull on this rope, and the man above on the rope still attached to him ; thus securing that the two men will each be pulling separately to raise the one weight.

The effectiveness of the double rope so used, however, assumes that the crevasse is one with open walls and clean firm edges, which will allow the second man first to anchor the one rope round his axe, and then move up and stand close enough to the edge to be able to pull in the second rope while his friend below does acrobatics up the anchored rope. But these are not the crevasses into which any observant leader of a party of two has any right to fall. Good men, if they fall, are trapped by snow-covered crevasses of indeterminate edges, or by the midway breaking of a visible but treacherous bridge. In such crevasses the fallen man will be under the projection of a lip of snow. He will be hanging free, probably unable to do more than touch the walls with his axe. The man above will have all he can do to hold on ; he may not be able to find secure snow within reach into which to drive his axe for the belay ; and his hands will rarely be sufficiently free to untie one waist rope, drive the axe and fix the rope to it, so that he can move up and clear away the overhang. The ropes will cut deeply into the snow lip with the weight ; and the friction hold of the snow in which the ropes are embedded will militate against the effective pulling upon his rope by either man. If the two ropes are, as usual, tied to the waist, the one will probably have twisted round the other ; both will be jammed in this position in the snow cut, and neither man will be able to distinguish on which rope he is supposed to pull. Even if they have been kept clear before, the cutting through the snow will twist the ropes and jam them, so that they cannot be used separately for pulling at all. The projecting snow will interrupt communications and interfere with any simultaneous action in pulling from above and below. Nor can the man below, suspended in air, really do much to help. Tie a rope round your chest and a bough ; drop ten feet on it, and then try to pull yourself up it ! And a man in a crevasse is much worse situated for attempting juggling feats. The constriction of the rope alone will soon make him helpless and later unconscious. The shock, the imminent peril and the cold will contribute to weaken him for the strenuous efforts required. Further, if the rope is tied, as it usually is, under the arm, the knot will work up under his shoulder and practically put one arm out of action. All the

strength of the arm will be required for merely forcing down the knot and noose, so as to keep it under the arm-pit; the moment the arms are lifted to attempt a pull, the knot will force itself up and half-paralyse the one arm.

It has been suggested, as a partial solution, that the two men should not rope at the ends of the rope, but keep some feet of loose end wound round the body. Then if one falls in he can, with luck helping him, release this slack and make a foot or thigh noose on which the body can rest while suspended, thus relieving the constriction of the chest. Anything that *may* help is worth trying, and I should certainly advise the method as giving a small extra chance in a bad situation. But this only deals with one of many difficulties.

Experience has again and again shown me that the man below becomes incapable of active co-operation, from cold and shock if not from constriction, before the men above, however prompt and expert they may be, can arrange and carry out any effective scheme of rescue. I have known of difficult situations where even two men above proved insufficient for the complex task of retaining firm fixed anchors, clearing obstructions and pulling up. In any case no mechanical device can be equivalent to the power of a third man, and two men can never be as safe as three.

Once this is conceded, we may admit that a number of good mountaineers will probably continue to hold the view that two is the best number for many sorts of climbing; and that therefore parties of two, starting out with the best intentions, will occasionally find themselves compelled by the necessity of avoiding even greater risk to hazard the crossing of snow-covered crevasses or bridges of dubious stability. They should certainly then put on a doubled or a second rope. One of the two rope-lengths when tied should be longer than the other. This runs risks of twisting and is a nuisance, but in case of a fall it secures that the ropes are at once distinguishable, and it should be prearranged that the man who has fallen should always do his pulling upon this looser rope. The second man should have the end of the looser rope attached, not to his waist, but to his axe shaft. Whenever the leader crosses an obvious bridge or pauses to probe, the second man

should plant the axe, with the loose rope attached, at once in the snow, and hold the other, tighter rope in his two hands, ready for emergencies. It is clear that on this method some practical use is made of the protection of the second rope. If the leader goes through, the second man avoids all the enormous difficulty of untying one of two taut ropes, of fixing it to his axe, and then anchoring it, with the whole weight of the man below dragging on him. The weight is on the one taut rope round his waist; he has only to drive in the axe with its slack rope already attached, and the fixed anchor is ready for the man below to start pulling upon, while he himself at once has his hands free to pull on the taut rope. Again, if the rear man falls in—which of course he has even less excuse for doing—this method has the advantage of keeping the second rope already loose and distinguishable in his hand, to cling to or climb upon, and also of saving his axe for him. This double advantage is some remedy for the fact that the leader, who in this case will be the man left above, will have both ropes still fixed to his waist, as on the old faulty system. I do not suggest that the leader also should have the second rope attached to his axe. He must have his axe quite free.

It might be well also to adopt the plan of the few feet of loose end wound round the waist, to make a foot noose with, if the circumstances and position allow.

When the double rope is worn, the rear man should always carry the spare rope. If the double ropes are then, as is quite possible, twisted and jammed in the snow groove, he has yet a third chance of making free and quick connection with his leader; and unless, as I have said, both men can begin instantly to use their full strength upon distinct ropes, there is small chance that one man can get another out of an undercut crevasse.

In place of tying the looser rope to their axe, some men prefer to compromise, and make a fixed loop in the second rope near their waist, through which, in case of the fall of a man in front, they can thrust the axe into the snow, and so get a provisional anchor. This loop in the rope close to the hand, to snatch at or thrust the axe through in emergency, is also used by men in larger parties when linked by the usual single rope. The method has many objections; and all the material

security it gives is quite as usefully and less objectionably obtained from the coil or so of slack we are accustomed to grip in the hand.

In the case of a larger party, if a leader or last man does fall in, the first care should be to drive an axe, or axes, securely into the snow, and loop the rope. One man must then approach the edge of the crevasse and see the run of the rope, the nature of the pull, and the clearance of overhanging snow, if any, which has to be made. If the crevasse has the character of a bergschrund, with one lip higher than the other, it is often easier to pull the man out from the opposite side to that from which he has fallen. One, or, if the numbers allow, two of the party must work round cautiously to the far side, taking a spare rope to let down. A noose should be made at the end of the rope before it is lowered. The stirrup for the foot can also well be employed in such emergencies. In a party of three, on a suspicious glacier, the spare rope should always be carried by the last man, and not by the first man, as is usually done in guided parties.

With the two ropes pulling from different sides the extrication is fairly easy. If the farther lip cannot be reached, or overhangs as much as or more than the near lip, there is nothing for it but to cut back the lip of snow overhang above the suspended man until the rope is cleared. This runs some risk of injuring the man below with the falling masses; but the chance must be taken on occasion. The longer a man hangs, the more helpless he becomes. Promptitude is essential.

Keen sight is the first quality for a good leader on snow-covered ice; to be able to remark not only every change of shade or colour or angle on the surface immediately ahead, but also to be able to read the surface well to right and left for its betrayal of crevasses that may be continuing, better hidden, across his path. He must also know all about glacier structure and the inclinations and aspect of surfaces where hidden crevasses may be expected. Tinted glasses are, for many men, an interruption to the reading of ice or snow, and often the cause of bad leading. The man is fortunate who is able to do without them when he is leading, or who finds enough protection in the clear spectacles which best suit his sight. There is an exaggerated idea of the

chances of breaking ordinary clear spectacles which has little foundation. They can be worn safely on almost all rock and ice; and even on very severe rock, where they run some risk of smashing as the head is raised past a ledge, they are as safe on the nose as in a pocket. Except right up under the arm-pit, and not always there, there is no contrivable pocket which can be sure of avoiding contact with rock in some attitude of climbing.

After our eyes—and our experience—we have still another criterion, that of the hand. The probing with the axe point at every step must become perfectly automatic, and begin of itself to function as soon as sight or instinct makes us suspicious about the glacier surface. We must have the right sort of axe point, one without a large protuberant collar to the spike, so that we can probe with nicety of touch; and we must get to know exactly the feel of our axe and the meaning of the different resistances which its point signals to our hand. For this reason it is well always to use the same axe or kind of axe.

Where our eye or axe probe has given us reason to suspect a crevasse, the next test is to flog the same spot lightly with the axe point. In dealing with sun-soft surface this flick goes deeper, with less exertion, and practice can make it a very accurate reporter upon the consistency. This too is its merit in testing the thoroughfaresomeness of visible bridges. Where also the snow cover is thin, the flogging stroke tells us more quickly than the prod where sound footing ends and the crevasse begins.

Snow testing, like walking with the axe, should be shared equally between the two hands. It is not only exceedingly useful to be equally dexterous and sensitive with either hand, but the practice keeps the muscular development even and the general condition of the body proportionately better.

When we are working through crevassed glacier the second man must always watch the meaning of his leader's movements, and halt and brace at once if the leader checks. The others watch each the man in front of him. It is essential to follow exactly in the steps on a glacier of this sort, even though the windings of the leader's tracks may suggest many pleasant short-cuts to the tail of the rope. By watching the men

ahead we know when we must be ready to let out rope, so as to enable the man in front of us, in his turn, to make a long step across a dubitable crevasse or a short jump, and when we shall have to pause and protect him with the rope, as his turn comes to start delicately over a presumed bridge. To hold the rope taut is irritating, to jerk it dangerous, and to leave it slack on the surface irritating and dangerous; the correct touch comes with experience.

The leader will always be on the look out; but the men behind will naturally be following with less close attention. Therefore if the leader comes upon a small crevasse or other easy obstacle too slight to cause him an obvious check, he should warn the man behind of its presence, as he strides on, by beating the spot with his axe; and the signal should be repeated by each man following.

Again if, when we are all moving together, we have checked in order to make some awkward step or to test a bridge, we must remember that in a few seconds the man behind us will be checking at the same place, and we must slacken our pace at the right second to allow him time to cross. It is a common and aggravating error to hurry on again so as to get into rhythm with the man in front, forgetting that the man behind will have slowed up for our pause, and will be jerked or scuffled by our omission to allow him the same margin.

The same rule applies if we are serpentining rapidly down a glacier, swinging so as to cross longitudinal or diagonal crevasses at the right angle. If we resume the normal pace the moment we have swung 'into the straight' again ourselves, we leave no time for the man behind to finish his parabola or cross his bridge. This is a roguery ingrained in all but the best of guides.

Glacier craft, the ability to choose in anticipation the easiest line down or up a volatile succession of semi-visible obstructions, and to surpass them safely as they become concrete, can only become an actual possession by long experience and unwearying observation. There is a family likeness between whole groups of surface configurations shaped by the same cause, which, however dissimilar their momentary association, will recall to a recording eye some past occasion of encounter, and will

suggest to a cool head and skilful hands the proven method of avoiding or defeating them in their new combination.

Glaciers form our avenues of tempting approach, and, as often, of tedious return. During the hours when human vivacity is on the wane the higher ice falls are opening always wider eyes of watchful malice. Towards their confounding not only ice craft but all the qualities which produce the *collective* strength of a party, from temper to the sense of direction, must contribute in concert. Among glacier ambuscades a party that has not found unity will fall to pieces. They are yet more demoralizing to one whose leadership is in commission,—that grievous blunder of divided responsibility, which, arising out of the sociable conjunction of two or more self-contained parties for the purpose of a single climb, leads too often through disjointed action to failure, and even, as our chronicles bear witness, to disaster.

A really united rope, well led, which can work through disheartening glacier falls long, and late, and *like* them, has graduated in mountaineering; and may be considered to hold the freedom of the great peaks.

SNOW CRAFT

The technique of snow craft is identical in its principles with that of ice craft. The upright balanced movement, the management of the rope, turning, anchoring, etc., are the same, or only slightly modified. Only points of detail, therefore, need be mentioned which are peculiar to the different qualities of snow surface. In certain cases, such as bridges and cornices, both snow and ice are in question, and the notes are then supplementary to those made under general ice craft.

To make snow steps is a matter of muscle and rhythm; to use them, one of balance and endurance; but to know how to avoid making them and where not to make them is the science of snow craft. We may learn to identify snow states by description: nothing but experiment can teach us how to deal with them.

We may classify the states of snow under many heads; but we are only practically concerned with three points: which of these states are pleasant, which are unpleasant, and which are unsafe to walk upon. Of most importance is it to be certain which states are likely to be unsafe, and to be able to recognize their presence beforehand.

Under Reconnoitring some suggestions are made as to the signs by which snow states may be interpreted from a distance, and some of the certainly unsafe ones consequently avoided in anticipation.

As to whether the state on a particular day will be pleasant or unpleasant, the weather of the day, the hour and the angle of the snow can tell us much. The final test must always be by touch.

Snow lying at above an angle of 20 degrees may slide whenever its support is not equal to its mass. Its support comes either from behind, the rock, ice or snow surface upon which it rests; or from its quality, the cohesion of its particles; or from below, the angle and mass of the subtending snow slope. In deciding about its safety we must take all those three points under our inspection. Of its sub-surface we know something if

we can ascertain the lie of the rock strata or detect the presence of ice. Of its quality and mass we judge by surface signs and our recollection of the weather. Of its support from below we judge by the angle at which it lies; not only by the angle of a specimen section, but the angle of all sections of the slope below.[1]

Some Characteristics and Countermoves.

Snow lying at easy angles, exposed to the directer rays of the sun, will usually be soft; and while we may be able to mince over its night crust before sunrise, we do well to avoid its possibilities of purgatory on our return later in the day. Snow on south and south-east faces for the same reason is the more to be respected, and its earlier deterioration must be accepted without resentment.

If a strong wind has been blowing, the snow on the sheltered side of a peak will be the softer and the more likely to avalanche. Snow on a sheltered face becomes loosened in fibre by the balance between the air-currents, whereas, on the windy side, it will get blown off or blown superficially hard.

If there has been Föhn in the wind, the snow will be untrustworthy all round. Föhn has the insidious quality of disintegrating snow through all its depth; it may appear to have affected the surface relatively little, but it will have reduced the under-snow to slush. This is the most perilous of avalanche states.

Snow may be expected to slide, under the usual conditions, not only after hot days or days of wind. Days of warm mist and diffused sunlight may be even more deleterious.

Certain states of snow may start sliding irrespective of all changes of temperature, at any time and on calm days, merely as the result of some slight disturbance. First among these is 'powdery' snow. This may be either fresh snow or old snow which has never been melted and refrozen. Older snow in a powdery state we shall only expect in summer to find at greater heights, where the daily sun has little power. Since we shall recognize by sight that it is older snow, and since

[1] See "Mountaineering on Ski," p. 424. This chapter should be consulted for the more detailed study of snow phenomena required for winter and spring ski-ing. In "Snow Craft" I have limited myself to the conditions that a climber may meet with in the ordinary alpine summer season.

it has neither blown off nor as yet fallen, we shall be reassured about its holding quality, provided that we can also make certain that it is not lying in great masses or at a minatory angle. Sometimes, although we may not have seen it, we shall get evidence of its presence above us, in the appearance on gusty days of cascades of thin powdery snow streaming like dust down the lower ice or snow slopes. In the Alps these wind cascades of old powdery snow are sensational to see or to feel pouring round us on a steep wall, but they are too light to be harmful. The difference in weight between a flying veil of dry snow and one of wet snow must be felt on the shoulders or ankles to be appreciated. Cascades, of a more threatening sound, betray to us the presence above of old granular or crystal snow. The grains are easily set in motion; but in the Alps snow of this sort rarely lies at a depth to be worth regarding. Old powdery or granular snow, lying at a good angle and in light mass, we shall expect to be laborious but not to avalanche:—at least until we have put it to its last test of touch.

New snow, as a dry powder, if it lies in large masses, must be expected to avalanche on all slopes of steeper angle. In lesser quantities, it may be started by wind or by an incautious passage. On ice or rock it is never stable, until it has been cleared away or melted and refrozen.

New snow, as a wet powder on rocks, is desperately chilly for the hands, and has the disagreeable quality of transforming itself into an ice glaze under the pressure of the boots or the glove. If we are caught out by a fall of new wet snow on rock, ice-claws will protect our foothold, but nothing will save the hands. I have known very few men whose hands would stand more than a very short spell of clearing out rock holds in wet snow. Gloves are soon saturated, and the ice glaze forming under the hand still further reduces the effective grip of the numbed fingers. It is this that makes climbing on rocks impossible for days after a snowfall; while from snow or ice slopes, where we are not so concerned with handhold, the same storm will restrain us by its threat of avalanches.

After a storm of any length, two or three fine days are required in summer for the rock to clear. The first

day of sun should melt the snow; the night following will refreeze it into a glaze: the second hot day will melt the glaze; and, with luck, the third day may find the rocks clear.

All wet snow, melting in heat or rain, in Föhn or after wind, is liable to avalanche, according to the angle at which it lies and in proportion to the amount of water which it contains. Only experience and touch can tell whether snow is or is not overcharged for the angle at which it is lying. It is astonishing what a quantity of water snow will hold without moving; and again, what a trifle will set it falling or arrest it. I have seen a whole quiet mountain face break into avalanches under the extra snow weight discharged during a few minutes of after-squall; and I have watched water-logged snow streaming like thin milk over the slabs, of a north precipice, stopping suddenly as heavy, cold grey clouds crept over the rocks, only to begin again the instant the clouds passed and the sun broke through.

Frothy snow, neither powdery nor wet, but of the texture of dry sea-foam, is not so frequent in summer in the Alps as in some other great ranges. But I have found it occasionally near big summits or high up on northern snow faces. In spite of its intimidating quality, it is safe at almost any angle if it lies on a good sub-surface. But it is infinitely laborious. A step takes us up to our waist or shoulders. Progress is only possible by flogging a furrow up it with forearms and shins, which leaves a trail like an ecstatic sea-serpent. Some relief can be got by slapping down the shaft of the axe flatwise above us and crossways to the line, and pulling up on it as on a horizontal bar.

Before venturing upon snow of definitely unstable type, such as powdery snow or wet snow, we must make certain of its mass, its angle and the nature of the surface below it. We then adapt our methods accordingly.

For instance, if we find that wet or powdery snow is lying upon ice at anything but a very low angle, we start by finding out if it is of the same quality for all its depth. If it is, we must clear it away at each pace and cut a step in the ice below. If the poor quality is only superficial and improves below, or if we notice that where the lowest skin of snow rests on the ice it adheres either in

a film or in measle-patches,—which signifies that the ice and the snow surfaces are going through a gradual process of peaceful interpenetration,—we can count on this lower snow surface for sure footing. We need not cut steps, but only stamp through the snow to a safe depth for a sound step.

If we have any doubt as to the security of a slope, which we shall have when the angle of the slope and quality of the snow are varying and the resultant stability is indeterminable, we must ascend or descend it vertically, if possible, or on very steep zigzags. We must take care to cross incipient cleavages, or traces of horizontal strains on the surface, at right angles, and never encourage them by letting the weight of our party tramp parallel to their length.

A steep slope of doubtful quality, if it has to be traversed, should be crossed as near its upper edge as possible, and this particularly if the slope is subtended by a cliff or a snow slope of steeper inclination.

On a slope actually showing traces of a recent slide, secondary falls may be expected. A snow slope is not a *sérac*, and it is not so safe to assume that all has fallen that can fall without close inspection. If we cannot see the place of origin we can make a deduction, as in the case of an ice fall, from the appearance of the nearer debris : as to whether it was a recent fall, a night or day fall, a surface skim, a local powder-rush or a sample of gravitating under-slush.

On the lee side of ridges which have been exposed to the wind, we must expect to find snow accumulations of a poorer quality, and liable to slide according to the angle at which they lie. This will be especially the case if the ridges are subordinate ribs descending from a principal ridge. On such ribs, if we find wind signs on the near side, we must be careful of the snow on the far side of each rib, and in all the adjoining protected hollows.

Good snow is either snow with a hard surface, or snow which, below the surface, remains sticky and light. Except at great heights, we shall only find snow hard before the sun has touched it. Before sunrise, after wholesome cold nights, we count on finding all snow surface good and every bridge holding. When we find soft surfaces in the early hours after a warm night, it bodes

us ill if we have to return the same way later. On hard, steep snow, wherever our boots begin to scratt fretfully for foothold, it is less fatiguing to put on claws, or to make a notch with a single one-handed tug stroke of the adze-blade. On very steep snow of medium hardness, when a handhold is needed, it is better to use the blade of the axe than the pick.

The more level the snow the more directly will it have felt the sun; the thinner will be its night crust and the softer its under layers. Therefore we avoid, especially later in the day, launching out upon the great snow plateaux and valleys of the higher regions of glaciers, such as are labelled '*Firn*,' '*Névé*,' '*Ewige Schnee*' on maps, names of foreboding. If we have to take to them, we keep to the sides, where the snow-levels begin to climb and the rays strike less directly. If we have a choice, we select the side or line which is subject to the shortest hours of full sunlight. Always, if they are there, we use old foot tracks. The floor of an old step melts and refreezes and, protected by its depth, remains firmer than its surroundings. On popular peaks these tracks can become immense frozen ruts, very awkward and ankle-racking to descend. It was reported one radiant year that a tourist on the final slopes of the Jungfrau had fallen into one of these 'steps,' and had been extricated with difficulty.

Snow Travail.

When we are really in for a steady plough through deep snow, the stride should be kept short, the knee bent, the weight well forward, and the body swaying from side to side—in fact we adopt the 'tramp's walk.' To thrust with the straight knee is uselessly fatiguing. On soft snow we are lost if we cannot achieve some sort of steady rhythm. The feet should be planted *straight*, and not toes outward. The length of the stride with either leg should be absolutely equal.

If the weights of the party are very uneven, the heavy man should precede. It is less fatiguing for a heavy man to make his own steps, where he allows beforehand for the 'give' of the snow, than to stride out behind expecting a firm tread, only, in two out of three steps, to find the floor give way under him. Irregular resistances are the negation of rhythm.

Unless he has the shortest legs of his party, the step

maker must always shorten his normal stride on soft snow. The length of the first man's stride is increased as each man behind slightly deepens the steps, until the last man may have to be making a grasshopper bound to reach from tread to tread of what started as a normal pace.

On soft surfaces, especially where the resistance is irregular, it is difficult to keep in balance, and the axe comes into use at every step. I have usually found it better to reverse the axe. The head, like a ski-stick, gives broader stay on level snow, and firmer touches against inclined soft snow, than the point.

Crusted snow, where the surface has melted and refrozen, but too lightly to carry our weight, is the worst snow of all. When it lies at easy angles, it may be extraordinarily wearisome to cross. It just bears our weight until the body is fairly over the foot, then it gives and lets us through. At least the half of each lifting effort is thus lost, and each fresh step has to be made from a yielding basis uphill on to a hard one. Rhythm is impossible, and the prolonged aggravation is demoralizing. For which reason I have found soft snow the one test of sheer endurance in which good guides are inferior to good amateurs. We meet it not infrequently in our own islands, and welcome it then as good 'alpine' training.

For really bad crust there is no countermove, except strong thighs and a high flat-foot step. On crust of a better character, especially before sunrise, a shuffling step, which distributes the weight, often saves the foot from going through, or lets it sink to a less depth. On some crusted surfaces it is possible to slide cautiously along on the shuffle-step, where lighter men, walking 'heel and toe,' are going through at each stride. When the surface is too soft for even a shuffle to save us, the tread should be made with the whole flat of the sole, and not with the heel leading as is usual in road walking. Under the flat foot, as under a snow-shoe, the snow packs more quickly. To pivot upon the foot, before the weight comes upon it, widens the bearing surface.

Soft snow cannot be taken at a rush. There is a peculiarly clinging and binding quality in the snow of old avalanche debris. These are just the places where

most folk start seven-leagued leaping. If we cannot restrain them, we make them take off the rope first. To be tied to a hop-o'-my-thumb when our leg has just entered binding snow, up to the thigh, at an acute angle to the pull is full of unpleasant possibilities. The wise man will continue even here to move lightly, and only as rapidly as balance and rhythm will allow.

On long monotonous snow wades, if we cannot get a good rhythm of legs or body, it is sometimes of use to supply its place by an artificial rhythm, counting the steps up to fifty and then pausing, or whistling, or following a tune in our head—anything that may introduce a rhythm, with rests, into the featureless vista of effort. The boredom that may afflict a party on snow is peculiar to itself. The even glare and the winding line of diminishing tracks hypnotize the eye and mind, and produce a conviction of exhaustion which is often in great part self-suggested. The wader feels that he absolutely cannot take another step. If counting fails, and other wiles and conversational red-herrings shrivel up in the silent white monotony, rest is the only cure. Sleep follows easily in such states, and a few minutes' slumber often restores a man or a party surprisingly.

On long snow plods it is best to get rid of the rope whenever the absence of crevasses will allow. It but doubles the uneasy travail. If it has to be kept on, avoid spoken remonstrance when the man before or behind jerks you; let the rope do the talking. If you are leading, keep a small, loose coil in your hand, so that the man behind shall not drag you in mid-step. If you are last, you can always exercise a salutary, silent check. If you are in the middle, and you have, as is frequent in tired parties, an energetic leader trying provokingly to press the pace in front and the weakest member lagging slightly but protestingly upon your rope behind, the best way to protect yourself, inoffensively, is to take up both their ropes in your one hand, and so link their opposing pulls directly on to one another. You can thus maintain equilibrium with no further discomfort to yourself. When I was learning the craft in early years between two guides, or a guide and amateur of unequal endurance, I had many occasions for perfecting the device.

The use of ski upon snow is treated of separately. Whenever summer ski have been made as available as ice-claws, there can be no doubt that they will cancel out for us as much of the technical consideration of these penitential snow fields as claws have simplified for us the labour upon all the angles of ice.

Snow Slopes.

To make steps upon inclined snow is a matter of little difficulty. The direction and weight of the kick are suggested by the angle and texture of the surface. But to use them calls for more care than is usually given to the matter. On soft slopes it is a nuisance if the step stamper has a length of stride that makes each pace a slight effort for us. It is better to remonstrate at once: to shorten the pace by refashioning the step is to break rhythm for the whole line. Of course on easy slopes, if we are out of the rope, we go as we like, provided that we do not exhaust, by eccentric following, the energy which we should be reserving for our turn in the lead. But as the angle increases, or where the going gets more heavy, men of any experience fall into single file; and then to make missteps, to tread a step down at the heel, or to step outside the line, is to throw the whole march of those behind us out of gear, and to waste our own energy in repeating the leader's work. It is impossible on snow not to be conscious of the leg swing of the man ahead. If he walks with the wrong foot for the trail, we are either drawn into his error, to our own inconvenience, or we resist the attraction with a conscious and tiresome effort. Our common rhythm goes. Worse than this, he spoils the steps for us. Nothing is more muddling, in ascending or descending snow slopes, than to find the steps broken or doubled. We bungle, and get the wrong foot for the leader's tracks; our body as a result balances wrong for their angle of use. In coming down especially, a bad second man, who lets himself lollop carelessly into tracks or makes 'tumble-steps' on either side, confuses every one behind him as well as himself. The whole party will be wasting temper and strength in choosing between a maze of 'joy' tracks, or in remaking their own in despair, where they should have been following mechanically on a ready-made line.

In using steps on steep snow of uncertain stability,

it is vital to tread right to the fraction of an inch. A tired man who steps a nail-breadth false on a descending ladder of this character will certainly cause some step to give, and endanger the general safety by a slide. He may explain that the step 'broke away'; but the fault has been his. It is the ideal of all good climbers, although very few men can live up to it, to use steps as accurately and with as dancing and precise a foot at the end of a long day as they did at the beginning.

If a snow step on a steep slope looks insecure, as it often may on wet snow after several men have passed, it is best to tread slightly inside it and scrape down a shaving of fresh snow to strengthen the floor under the foot. But this intentional over-tread should never be made on the outside of a step. If a step has broken away and a new step has to be made, it should be trodden, similarly, inside the old one, over but not exactly in line above the broken step.

Descending on snow of poor quality is oddly nervous work. The descending action is awkward, as upon ice, and there is the added doubt as to what will happen when we drop on to the foothold. Every one has days when the muscles are stiff and when the descent of shaky steps does not go in easy balance. At such times it is reasonable, and safer, to make 'arm-scoop' holds to help the balance on the step-down. We may do on snow what we may not do on ice—take the weight momentarily off our foothold on to the arms; because on snow, if some one else slips, we can at once drive another foothold with the heel and get into balance for the jerk. In coming down steps in soft, steep snow which have been worn away by previous members of the party, it is often even advisable to make these arm-scoops in order to save the effort of making new steps and to lessen the weight on the old ones.

On high, popular ridges in fine weather the lines of old steps with their floors refrozen and their shape spoilt are often uncomfortable to use on the descent. For the mountaineer the whole day should be equally of pleasure. The more the difficulty of the climb is over the more we may consider our comfort, even to the point of demanding a new set of steps.

On steep zigzags, if we are crossing and recrossing

one another, we remember to give the man below us ascending, or above us descending, time to make his turning step at the corners. If we do not slacken, we shall jerk him or force him to let out his hand coil just when he is most occupied with the turn.

On big faces, of yielding snow, we find firmer stepping up the wind-blown crests of the undulations, often only detectable by their correspondence with the buttresses descending from the cliffs above. Conversely, on faces of recalcitrant snow, we foot it more lightly up the troughs between the waves.

The Rope and Axe.

Except on hard morning snow, or on snow where we can make absolutely certain of what is happening underneath, it is a good principle to retain the rope. Progress is quicker than on ice, but sight and prescience can ensure us less completely against the accident and the unseen. As a partial illustration of the distinctions to be observed, a strong party might be justified in making their way unroped and on claws up a formidable dry ice fall; but they would, if they knew their business, then put on the rope to traverse the easy but snow-covered angles of the *névé* above, seemingly far safer than the *séracs* they have just passed singly and unroped.

"What is happening underneath" must be interpreted to mean not only what may be lurking underneath the snow surface, in the way of ice or crevasses, but what is happening below us on the mountain side. We keep the rope on unless we are *certain* that the breaking of a step or a slip will lead to no worse results. If there is a long, steep wall of ice or snow below, or the suggestion of crevasses or a bergschrund, or a rock cliff, or even a section of the slope which we cannot see and which may contain a cliff, we may take no chance, and the rope must be retained.

On all smooth snow and ice slopes, unless we are moving short-roped over safe and fairly even glacier, the rope-lengths between us should be allowed to 'travel' lightly on the surface. This lightens the draw of a heavy rope carried on the waist or hand, and avoids the strain upon the balance. Too much travelling rope is a drag; too little tightens on us like a brake. The hand must get to know by feel when there is just enough down to let it travel lightly and freely. The hand, too,

as on rock, must learn the habit of freeing, freeing the rope continually, so that it shall not catch. Over rough surface we raise it clear; and over 'suspected' glacier we keep it all but taut, taking up the slack in a hand coil.

We may never trust snow steps, unless in a very fine quality of snow, to carry more than our own weight. In protecting others of the party, therefore, we cannot, as upon ice, rely exclusively on balance and our foothold to take the jerk upon our rope in case of a slip.

To anchor, on all steep and doubtful snow slopes where the angle or the quality of the snow advises the retention of the rope, the axe must be thrust into the snow beside and above us at every step. It is driven to the head or to just beyond half its length according to the condition of the surface. The rope is passed round the shaft and rests on the snow, so that in case of a slip we get the friction of the snow into which it cuts to help us. At a turning step on a zag the rope is put round the shaft in the reverse direction. This driving of the axe and the looping of the rope men should execute when the feet are at rest on the holds, and not, as many do, while they are taking the step. It is often very difficult for tired men to continue for hours the regular thrust of the axe and the careful anchor of the rope at each pace. But just on those angles and on those types of surface where the precaution is most laborious is the protection most needed. Snow is not ice, and in proportion as snow steps are easier to make they are easier to break, and more in need of assistance from the hand.

On the sharp edges of big ridges the true footing is often along the crest itself. If the crest is too frail for the feet, it can still provide the best bedding for the driven axe or an armhold. If the snow is really threatening, and it is unsafe to trust to steps along the side or on the edge, it is occasionally preferable for two climbers to make their own steps along opposite sides of the crest, with the rope riding across the snow edge between them *à la mode Tartarin.*

If rocks or obstacles forbid us to use the rope in this literary fashion, on such risky snow we shall, of course, only move one at a time. To secure a safe anchor step while the other man shifts, I have used the device

of driving the axe almost up to the head, and then standing on the snow crook immediately behind it.

To arrest another man's slip on steep snow, the snow itself must be used to minimize by friction the jerk of the rope on axe and arm. Any bulge or corner of snow will serve, for the rope to play over and, slowly, cleave through. I have seen a rope, held across a sharp slanting edge, cut four feet into the snow under the weight of a sliding man; the friction stopping him gently before the jerk came upon the axe. If there is no corner to help, we must lean the whole weight of our body upon the rope where it runs out to us round the belay on our axe; so crushing the racing rope into the snow and reducing the final tug upon the driven axe shaft.

The crossing of the obvious bridges over the bergschrunds that subtend snow slopes is an art by itself.

Bergschrund and Bridge.

Flat or snub bridges are less secure than bridges that display a Roman archness of irregular snow on their upper surface. If the bridge is steep enough to call for steps, the steps of the leader should be followed absolutely, unless he has previously cast doubts upon their validity by falling through them. If the centre of the bridge, or the spring of the arch at its higher end, appears too frail for steps, and the word be given to crawl, the crawling should be done quite flat, and the body pulled along by the axe. To fox-trot on hands and knees is little safer than to walk on the feet.

If the bridge is only doubtful, we cat-step across it with the lightest foot we can. We carry the axe at thigh level and at right angles to the body, so that if a leg goes through, the axe comes down on the snow like a rail under the arm, and has a good chance of catching on firmer snow at either end. I once dropped ten feet into a crevasse, and was stopped thus by the axe under my arm-pit hitching between the narrowing walls. If we feel a foot going through, we must avoid above all things our first impulse, to throw the weight convulsively on to the other foot. The whole body should be allowed to fall forward flat. A swimming movement with the arms then often extricates us without further collapse. Of course on no bridge may more than one man cross at a time; and for a doubtful bridge at least

two men must be stationary and anchoring the rope of any man crossing.

A steep bridge of unproven security is often best crossed, on a descent, by a prone glissade. If the bridge has an obviously continuous surface, we may prefer to fly it head forward and face down, because clothes admit less snow in such fashion. But if the continuity is doubtful—and the fact is often difficult to ascertain from above—it is best to shoot the bridge lying on the back and feet foremost. The hands and feet are held ready to shove off backward against the snow, and we are ready to finish the crossing on a flying jump, should a breach appear in the bridge as we approach it.

If there is no bridge, we sometimes have to jump considerable widths and depths. It is better then to take off soon, and not to yield to the temptation to creep just a little farther down the steep, crumbling upper lip of the schrund. Too long a descent often ends in a slip as the wall steepens, and it requires a nice judgment to continue the slip discreetly, and shove off for the jump at just the right instant to carry us across to the other lip. For a high jump into soft deep snow it is permissible to throw the axe ahead; and it is essential to see that there is enough rope out for the jump. Again, if a man has jumped and is shooting on down the snow slope beyond the rift, it is kinder not to be in a hurry to stop him categorically with the rope. On lower snow slopes the angle is rarely too steep for a man to be able to stop himself gradually and less painfully, helped by friction and the merest suggestion of restraint. Jumps of more than twenty feet into soft snow have been made; but they are not agreeable. If the snow on landing is at all sticky, it binds at once round the legs, and threatens a break or a severe strain as the weight of the body travels forward above them.

The cunning of hidden cornices cannot be overrated. Its detection is dealt with elsewhere.

Snow Cornices. Once we have located what we take to be their line of junction with the parent snow crest, we must allow a further broad margin in selecting a safe line for our steps. I have known a section of cornice thirty feet deep break away along the line of our steps, when we thought we had allowed a good ten-foot margin from its line of junction.

The heavier the cornice, the deeper the margin we must leave; not an easy rule to keep, as the snow curve backing a big cornice will be all the more gradual and solid-looking. Leaders are always apt to cut the margin too fine, for the reason that the farther we move away down the back of a cornice, the steeper becomes the slope, and the harder probably will be the snow for step-making. At great heights the same cold winds which blew the cornice may have blown the snow slope to crusted snow or snow-ice; whereas, where the angle eases off right upon the crest and the back curves over into the cornice, the direct exposure to the sun will often produce a band of softer snow, easy to kick steps in. When we are dealing with huge ridges and long distances, it is very trying to have to continue to cut steps at a snail's pace, on a steep wall, when three feet above there is a line where we could walk. But these are just the situations which differentiate between good and bad mountaineers. Danger is a matter for our individual judgment, and if a guide, however famous, makes steps at a level that seems to our mountain sense to allow too narrow a margin, we need never have the least hesitation in starting to make another line below. The implied criticism is better than remonstrance.

Occasionally when the cornice is not too big and its back is ice-crusted or exposed to a high wind, it is possible to work along underneath it, below the crest of the wave. This must be done with caution; the shock of step-making may easily loosen a section of the overhang on to our heads.

Where a ridge is surmounted by a double cornice, that is, by two cornices curving opposite ways, one on the top of the other, there is simply no safe way of getting past them. Parties who persist in traversing a great ridge when they find it in this condition must be persuaded that their luck will take pity on their understanding.

In approaching the edge of any ridge, if it is not otherwise obvious that no cornice exists, the leader must test for the cornice every few inches with strong, deep thrusts of the axe shaft. The rest of the party, protecting him with the rope, must remain well below on the face until he has demonstrated that no cornice exists, or until he has had time to locate its line and to return to a point well below the junction. Such a crest

should never be approached diagonally, lest two men might find themselves on the cornice together, but always at right angles. If an uncorniced ridge gives us reason to suspect, as we follow along its crest, that a cornice is beginning, at least two of the party should descend well down the face (if rock anchorage is not available), and protect the leader while he investigates.

If we wish to cross a ridge or a pass and the far side is overhung by a cornice, the leader must be strongly protected while he flogs away a section of the cornice, back to the sound edge. A large slice in this case should be cleared away, as adjacent parts of the cornice weakened by the fracture may fall upon the party subsequently as they descend. These crossings should never be made where the cornice is really heavy.

We shall never, of course, approach a crest up a wall crowned by a large cornice; which is equivalent to climbing deliberately up under a toppling *sérac*. A light cornice we may approach, but preferably at a point where it has broken away. If no such gap exists, we may be forced to cut our own skylight through it. This calls for great caution and skill; a small fragment may easily sweep away any man below us on the slope.

Snow in Couloirs.

In couloirs and chimneys snow can remain at a higher angle than on open slopes, and presents therefore some exceptional features. Certain of these are dealt with under other headings. Snow in a rock couloir, late in the day, must always be tested before we descend on to it. This can sometimes be done with less trouble by throwing heavy stones on to the surface. The way the snow spurts or squelches or rives to receive them tells much to the practised eye. If they start a surface avalanche they may either betray ice below, or they may leave bare a tract of hard under-snow down which we can kick good steps. The presence of ice below snow is often evident at the edges where the snow-ice splays out on to the containing walls. The testing process should be repeated at intervals, as we descend, on doubtful snow. A long couloir, of pure snow above, has frequently ice below snow in its lower sections.

In descending couloirs of uncertain snow, we naturally make use of the rock walls, when possible, for belays or holds. There are often good leg stances between the

rock and the snow, where the snow veil has shrunk away, with an ice-trimmed border.

If the snow is of good quality, we proceed as we like; but if it is shallow, lying on ice, or of suspicious consistency, we ascend it in as direct a line as possible, or in steep zags, with a disposition to keep near the sides. On really threatening snow we ascend and descend by means of the vertical ladder of apses or pigeon-holes, climbing face inwards, and using both hands and feet. Our tread in this fashion is more feline, and our weight better distributed.

If we desire to leave a snow couloir by the rocks on either hand, or to use the rocks to help the ascent, it is sage first to try the side which is exposed for the longest time to the sun: the snow adhering to these rocks will be kindlier, and there will be less chance of an ice glaze. We have, however, to remember that the sunny side is usually that upon which falls of stones start earlier and occur more frequently; and our decision must depend upon the evidences of their spoor on the snow.

Outcrops of rock, in large snow couloirs, on ice or snow slopes, often appear as welcome islands in a long labour of step-making. But outcrops are apt to be more or less disintegrated, according to the character of the rock. If they are not rotten, they are not unusually rubbed bare and holdless by the passage of ice, stones and snow over them. Such islands, on ice slopes, are nearly always encircled by harder ice for a space round their lower walls, which increases our labour in approaching or leaving them. On their upper side they sometimes support a convenient spit of good snow. On the whole, they generally give more trouble than they save.

A particular type of couloir which is found in the Alps is worth mentioning, because of its false heart and honest, grubby face. These are the easy couloirs that debouch on to the glaciers at the bases of many sound granite peaks. They are plastered inside with loose rubble and snow or gritty mud, and we assume sound granite at the back. With dirt and care they seem fair enough to scramble down. But they are often in a precarious state of deeper decay. The passage of the party will start a gradual or rapid dissolution; and on occasion I have seen the whole cuticle of couloirs of this type, grubble, snow and large rocks, slough itself

off on to the glacier a few minutes after the descent of a party. They should always be tested before entry by discharging large rocks down them, to prove their honesty or expose their enamelled senility.

Snow at Home.

Among the Scottish mountains practice of a very useful character in our snow craft can be had during the winter months. From November to May snow will be found of different qualities: the best during March and April. On northern and eastern faces we may get step-cutting on hard crust and ripple crust, passable glissading, and happy experience of small snow slides, large cornices and snow travail. On north faces, exposed and crusted by the cold winds, snow will stay at an exceedingly high angle, and as there is small risk of underlying ice, we can adventure admirable practice in very steep snow work with more excitement than peril. The snow couloirs at times introduce us to bergschrunds, and, educatively, to reconnoitring exercises in identifying the respective runnels of stone fall and water spurt.

On north faces in the Lakes and in North Wales normally the snow work is confined to the first quarter of a cold season. Ice is rare, except as glaze or as frozen water-fall or drip in wet gullies sheltered from the sun. Step-making is commoner than step-cutting. Of snowy, icy and glazed rocks we can get more than we may desire; but for snow technique little but practice in travail, step-kicking, back-sliding, rope craft and blizzard-facing,—all very pleasurable holiday experiences, for which it is worth while taking down the ice-axe.

It is curious to note that ski-ing as a common device used once to be practised by the boys and herds of the north, the primitive ski being formed out of the hoops of barrels. The custom has now lapsed: the effect of the enclosing of the hills by walls, or of the boys by Board Schools. The reintroduction of some less elaborate ski might revive a more romantic spirit.

Confusing Weather.

In fair weather route finding on snow has no difficulties comparable with those of ice or snow glacier. The flaws are obvious, and there are no hidden angles. The one complication is weather and atmospheric condition. As a result of the somewhat featureless simplicity of snow slight changes produce more serious confusions.

High wind is always an enemy,—not only on snow. A mountaineer is more afraid of going out on windy days than on days of rain and snow fall. On snow, wind finds a new weapon to hand in the snow particles, whose blinding assault interferes with the discretion. The sight of the faint blur of snow as it is blown up from the skyline of a high ridge will always give us pause: no passage there will be possible while the halo remains. Wind and snow combined may confuse the best of mountaineers, and often the compass proves the one rescue from a complete reversal of direction. However resolutely they march, few men can resist on a long tramp the impulse of snow or wind on their faces to swing unconsciously one way or the other for protection. A shift of wind in a mist may take a party, steering by it on snow, through a complete circle. I have known of men, attempting a descent on the sheltered side of a level but interrupted ridge, who were led, by a spinning wind in mist, through the ridge and back along its other side to their starting-point, and all in twenty minutes.

But even when unsupported by wind or obscurity, a slight depression or a light cloud may make way-finding difficult on even snow, where there are no rock outlines to penetrate its guile. A diaphanous mist, approaching in tint that of the snow surface, is sufficient to conceal or completely alter distances and angles.

In cases where the mist exactly combines in tone with the snow, a curious phenomenon makes itself uncomfortably evident. The leader on a snowy crevassed glacier will suddenly, and apparently wilfully, begin to fall into crevasses which are visible to those following behind him on the rope. They will marvel at his stupidity, until they begin to lead themselves, when they will reproduce it. The reason will have been that whereas those behind have some dark object, man or rope, upon which to focus their eyes, the eyes of the man in front, looking only upon a uniform blank surface, go out of focus, and become unable to distinguish between details of the same tone. Any detail darker by contrast—a rock, or the length of the rope ahead, or even the sight of a distant peak,—for such mists are often transparent—will yield them a focal point again. If he has no such natural assistance, the leader must keep looking methodically at his feet, and then forward. This will

discover to him the nearer crevasses. For a longer view he may try the device of balling snow, till it crushes to a darker colour, and throwing it ahead: he will then again be able to see more distant details in their relation to the passage of the snowball.

In a mist or at night, on glaciers, or on snow slopes where there is reason to suspect the neighbourhood of rocks, it is possible to keep direction, and to discover towards which side of a slope or glacier our march is tending, by shouting, and calculating our position by the time it takes for the echo to return from the rock on either side. Across smooth slopes a very small and remote obstruction will give echo to our appeal.

On open snow slopes where there are no retaining walls, the best method is to have the full length of the rope out, and put a man with the compass at the rear end to correct the leader's line. If a compass is lacking—if it can ever be lacking in the mountains!—the man far behind is still in the better position to judge, by the pointer of the rope, whether the line is being maintained or is inclining either way.

If a return in mist over the same ground is expected, the tracks should be made intentionally deep, in order to reinforce the line against the sun's action, which may be all the more rapid when the light is diffused through such mist. The axe should be driven deeply into the snow at short intervals, so as to leave marks which may last longer than footprints; and this especially on hard snow.

On rocks or snow in mist, and even with less excuse on clear days, some other-land climbers adopt the device of marking the line of return at important points of divergence by squares of red paper fixed under stones. In emergency these can be of service; but they are unsightly, and their frequent use encourages climbers to pay insufficient attention to a very important part of their work—which is to note and record in memory the details of a route against the time of their return. A climber who has to find the return line on difficult rock or glacier, or on any climb that winds by devious ways, should never omit at all points of divergence or of salient indication to turn round and note how the passage or kink looks from the opposite direction; which is generally very different from its aspect on the

approach. Distant views are often confused and absurdly distorted by mist; but details close at hand, for whose memorizing alone red paper could be a substitute, are seldom sufficiently obscured not to be recognizable by a trained observation and memory. Only in two cases —one, the rare event of an expedition over fog-bound snow being continued with the intention of return over the same line; and two, equally singular, the case of a party, which contains only one mountaineer capable of leading the return route, attempting in mist a climb whose difficulty will necessitate the expert going last on the descent—would the use of red paper seem to be justified. Waste paper is inelegant, and makes an unimpressive substitute for hill craft. But mist is a subtle enemy on glaciers, and we may sympathize with folk who meet it by tricks when they happen to have brought a box of them with them.

The Sense of Direction.

In the end, and behind all memory and observation, we have to fall back upon that useful but mysterious faculty, the sense of direction. Its existence is often denied, especially by men who do not possess it, and its workings are attributed to powers of observation, to unconscious memorizing and to reasoning. But no one who has mountaineered or travelled much in uncharted ground with men of very divergent or very similar powers of sight or experience will be found to discredit its positive but entirely accidental possession. Irrespective of sight and independently of the presence of any other respectable mental faculties, some men are found to possess it and some not; and no experience or study will ever equalize the capacity of those who cannot with that of those who can exercise it in dealing with misty conditions or unknown country. Men who have it only in a slight degree frequently impair its fidelity by training their observation and memory. By taking thought we can nearly always confuse it, in ourselves or in our neighbour; and this fact has especially to be borne in mind in dealing with less educated brains, such as those of guides, where its working is unconscious when it exists at all. A pertinent question or reminder may often set them, or ourselves, thinking or doubting, and lead to hesitation or wandering where a moment before confident movement reigned.

If we have once made certain that a guide or even a younger or less experienced climber possesses it, we may accept its leading thankfully in moments of doubt, although its counsel may contradict our own reasoning or conscientious observation.

Those who do not possess the instinct, and those who possess it only in a small degree, will find it almost impossible in thick mist on featureless snow to avoid the inclination to turn in a circle, generally to the left. In mist, with the most resolute intentions, it is at times even difficult to correct the inclination, by allowing for the stronger thrust of the right foot (or whichever may be the leading foot in our own case) and by taking the axe in the opposite hand to that foot; or by discovering and allowing for our exact amount of bias. The compass is the only secure guide for the ungifted.

Some men have the sense in the form of an ability to keep a straight line once set, no matter what the obstruction or obscurity; others in the form of knowing their position in relation to any near or distant point they have previously visited. With a few the sense is polarized; they 'feel' the north. My own sense indicates only direction between points already visited. Although making all allowance for the leading foot, and conscious that as leader I was being kept to a straight line by the compass in the hand of my last man, I have myself in thick mist on level snow, after forty-five minutes of what was actually straight marching, felt positive that I had led the party through one complete and one half-circle to the right, so strong was the instinct to turn to the left in spite of all precaution and prevision. On the other hand, I have watched a man who had been brought round from Hammersmith to South Kensington by Underground on his first visit to London, and set to the task without previous warning, take and keep, in thick fog, the most direct line back again through the maze of cross streets; which he could not be said to be seeing for the first time, as they remained invisible. A singular case was that of a high Wrangler, a mountaineer, whose sense of direction was acute, but inverted: it indicated points precisely opposed to the correct ones. Once we had discovered this, and allowed for the idiosyncrasy, we made frequent use of his

otherwise very exact sense. For those who may have interested themselves in the faculty, I will add that this friend similarly produced or wrote down the results of all mental calculations with the figures in the reverse order.

GLISSADING

Glissading is an art that rewards the skilful. For the inexpert, though the pleasure in its prospect never dies, the actual performance is more often productive of aching shins and wet clothes, than of birdlike exhilaration. Until ski-ing came in to complement it, and we may say to improve upon it, glissading gave its artists their nearest approximation to the sensation of flying. Its physical thrill is very little less intense than that of flying on machines through the air, because the exciting vibration of the feet over the solid surface provokes a lively consciousness of pace and motion disproportionate to the actual rate usually attained.

But it has never been widely recognized that the art has to be learned. Very little has been written about it, and much of that little has been fundamentally wrong. All men glissade in a sort of way, as a kind of amusing frolic, with tumbles forming an integral part of the fun, like the periodic shrieks of the ladies on the Earl's Court roundabouts. But men who know how to glissade, and how to use its opportunities as a real auxiliary to their mountain progress, have always been the exceptions. Guides are seldom able exponents. More than a dozen fatal accidents are directly traceable to bad glissading.

Fortunately, the greater popularity of ski-ing has come to the rescue, and its more general practice should have prepared both the minds and feet of a much larger number for a more serious treatment of their mountaineering glissading. A man who can ski is halfway to becoming a good glissader. A good glissader, once the first surprise of the ski feeling is overcome, finds many of the simpler ski motions familiar.

In learning to glissade, a man has three points of normal contact which he must learn to control: his two feet, and the shaft-point of his axe. There is also a fourth point of possible contact, with which I deal separately under sitting glissades. The head of the axe,

except in one very rare case, is useless for contact, and should never be brought into play. In fact, during the time of learning,—and to learn properly will take as long as has to be devoted to the beginnings of ski-ing,—it is better to use only a stick with a single point, or a ski-stick. The axe head during the preliminary falls is apt to point too keen a moral.

A certain school of icemen, the devotees of the short axe, keep the axe head always sheathed in its leathern cover. In glissading the practice has distinct advantages : it preserves the keenness of the edge, protects the climber, and is far warmer to grasp. Those who learn to glissade with an axe and not a stick may well copy the practice. This suggestion applies to learning both on snow and on glacier.

On Ice

Glissading on ice is practically confined to short rushes on glaciers ; even there it is generally avoidable, but its mastery adds a delightful possibility of directness and pace to the late returns down ice falls.

No sane man will ever start a glissade on ice on a mountain side, unless the slope is evidently short and is seen to end in safe arresting snow, or in the earth deposits found on Himalayan glaciers. The sheer pace and rude vibration produce helplessness and, soon, unconsciousness on a steep ice slide of any great length. Control cannot be maintained for more than a brief period of inevitable acceleration. Often, however, quick bands of ice intrude, visibly or not, on a steep snow glissade, and it is then important to be able to make the new adjustments required by ice ; and so avoid being thrown out of balance by the sudden alterations in the quality of the surface flashing under our feet.

In ice-glissading the point of the axe takes practically all the weight. It is essentially axe riding. The feet become only props to the balance. Ice is rarely quite smooth, and, if the weight is at all on the feet, the slightest irregularity or 'stick' in the surface at this high rate of speed throws the heels back and over the head. The right hand grasps the shaft, just sufficiently far from where the point touches the ice to avoid scraping the knuckles. The left hand

Positions.

grips the head. The more the left hand forces the head up, and the greater the weight that we throw upon the right hand holding the shaft, the sharper is the brake upon the pace, and, incidentally, the more prepared is our balance against an accidental trip.

On hard ice the feet cannot be used to brake; nor, except by very gradual movements, can they attempt to steer. Their business is to carry their small proportion of the weight as lightly as possible over the irregular surface, and, like the front wheel of a bicycle, to prevent a forward or sideways fall. On rotten ice, if claws are worn, braking with the feet is possible by driving in the heels; but such surfaces are unusual in the Alps.

The knees must be well bent, with the body bowed almost into a sitting position, so as to keep the centre of gravity well down upon the supporting tripod of legs and axe. The zigzag spring, formed by the curves of knees and body, absorbs most of the jar. The soles rest flat on the ice, with the toes pointing down the slope. The feet should be kept slightly apart, for the better balance over roughnesses. To avoid obvious lumps they can be slid more apart or brought together. If they are used to steer at all, they must both be pointed sideways in the desired direction; but no attempt can be made to drive in the edges of the boot, as is done on snow. This would merely result in a fall. Steering, in this position, must be left to the gradual friction of the soles inclined sideways and downwards, and, in the main, to the swing of the weight on the axe.

On very rough ice, or on the rough icy surfaces found in snow couloirs, where we cannot make certain of keeping on the feet if we face squarely forward, it is best to adopt a sideways position of the body, the sides of both feet in contact with the slope, and one foot just below and slightly separated from the other. The distance between the feet must depend upon the character of the surface and the angle of the slope. On an easy angle of rough slope, where it is desired to go slowly and stop at any sudden point, the lower foot, with the knee only slightly bent, can be thrust well ahead, taking somewhat more of the weight, and acting as a shifting brake. On steep, rough ice, or wherever it is desired to increase the pace, and at the same time to protect the

balance, the feet, still in the sideways position, should be kept close together, while the knees and thighs are drawn up into a crouching attitude. The weight, of course, still rests mainly on the axe.

On steep, rough slopes of snow and ice alternating, where the balance is easily upset by the changing surface, this squatting or crouching sideways position must always be adopted, with the heels slightly apart and brought right up under the body, which practically sits upon them. The centre of gravity is then well down upon the three points of contact, which are all in firm and close relation to one another, and the balance is steady. Ice-glissading is possible for the expert, in this position, on many long ice intrusions where ordinary folk have to creep carefully down in steps. For a beginner, the under faces of the great ice hummocks below the falls on dry glaciers give the best practice, as their length and angle can be selected. Since near the crest these concave faces are often vertical or overhanging, early practice should be limited to their lower curves.

As in ski-ing, the start-off from the rim of an ice slope or from the crest of an ice wave is the most difficult moment. We cannot jump into our glissade as we can upon snow, or at least only on ice of very mild angles. The right position is to start in a 'crouch,' with the toes just over and the heels just holding the ice edge; the weight is then thrown back upon the axe, the toes turn down and the legs shoot out. As soon as the balance in motion is secured, the forward, the sideways position or the crouch, is assumed according to the feel of the surface and the angle.

On very steep dry ice, for the first body length or so at the start of a slide over a vertical or overhanging crest, be it on a glacier or at the top of an ice couloir, it is sometimes necessary, in order to remain in contact with the concave surface at all, and not to be flung out head foremost by the kick of the axe point against the ice, to leave the 'crouch' the instant the feet are launched, and to shoot out the legs to their full extent. The whole length of the body is then held rigid, with the feet pressed as much as possible sideways and flat against the ice. In such a position there is considerable risk of cutting knuckles or other surfaces against the ice. The position is,

of course, only required for a second or so, as no glissade may be attempted where the angle does not ease off sufficiently after a few feet to allow of continuing the descent in one of the normal attitudes of controlled glissading.

The fortunate will sometimes find an admirable surface on the more easily inclined planes of lower dry glaciers, where melting and freezing have followed one another during the day. The ice is so slippery that it is only possible to walk with maddening dislocations, and it is generally too level for a long glissade. It is then often feasible to adopt a ski-ing or skating stride, and strike out with either foot alternately. On a good surface and angle one may find oneself travelling in this way almost as easily as on skates. Similarly, on the wet lower ends of afternoon glaciers, if rubber-soled shoes happen to have been brought, it is worth while putting them on. One can drift down on them as lightly as on ski.

If the balance is once lost upon ice, and there is no prospect of an early arrest on a softer surface lower down, it is best to turn on the back, keep the head and hands off the ice, and force the point of the shaft back under the arm-pit and into the ice, so that the weight dragging on the shaft may gradually arrest the progress. The body must be kept head upwards; the legs, if slightly apart and rigid, will help to check the pace by friction and by the rugosities encountered by the heels.

Arrests.

If in such case the ice slope has been badly chosen, and the fallen glissader perceives that the only hope of avoiding a fall over rock is to stop the slide at all hazards, the risk must be taken of turning over on the face. The head of the axe must then be gripped with both hands, so that the adze-blade rests just over the right shoulder, and the pick-point is ground into the ice with the whole weight. It is useless to attempt to force in the pick if the axe is held only by the shaft, or at the stretch of the arms above the head. The axe at arm's length will be torn from the hands the moment the pick touches the ice.

These two methods of arrest can also be turned to account in checking falls on steep and hard snow, or snow with a crusted or icy surface.

On Snow

Even more on snow do the positions for glissading vary with the angle and consistency of the surface. The expert glissader changes from one attitude to another, as the feel of his feet on the changing surface suggests, without loss of balance or even a check to the pace.

The axe should be grasped as for ice-glissading. The knees should be bent, slightly or more according as the surface is slow or fast, forming a convenient arch of balance for the body. The bent leg acts as a strong spring to absorb jolts, and it is more quickly and powerfully adjustable to the changing demands of balance, when the body is in rapid motion, than the straight leg. To keep the knees straight is impracticable on all but perfectly uniform 'show' snow slopes. Those who have at times advised it have been influenced by some pictorial ideal which had small regard for the mechanism of the body or for the conditions of the glissade in action.

Positions.

The body should not be bent forward or crouched, as is done in ice-glissading, but held upright or inclined slightly backward, so as to form a continuous and concordant arc with whatever may be the curve of the leg at the moment. The lower end of this curve will always be bent more sharply at the flex of the knee; but in proportion as the knee is more or less bent, the graceful inclination backward from the hips will vary correspondingly.

The shoulders, especially that above the hand on the shaft, should be braced well back, and the head inclined a little forward, for better sight. The tendency to let the shoulders stoop forward and the body sag downward into a sitting position has to be resisted on snow surfaces. It is a false position, that follows inevitably on an attempt to keep the knees straight; and it is as bad a beginner's error as the inclination to sit forward and not back when learning to jump on horseback. The fact that it has been suggested as the ideal attitude, both in description and in illustration, may have been responsible for the large number of mountaineers who have never become more than 'axe riders' in snow-glissading. Sagging and axe riding are necessary in ice-glissading,

where we do not attempt to balance on the feet, but depend for safety and steering upon the axe brake. On snow the good glissader aims at reducing friction and riding by balance. To sag or use the straight knee throws us back upon the axe for balance and for our steering. Straightened knees mean the weight on the heels and the toes up; but if the weight is more on the heels than on the toes, steering with the feet is impossible.

The feet should be kept close together, with the toes pointing down the slope, so as to reduce friction and facilitate foot-steering. If the surface for a space gets icier and rougher, the feet are allowed to separate slightly, so as to secure the balance on their wider base and brake the pace by the angle that the two outward-pointing toes make with the direct line of descent.

On good snow surfaces to draw the feet slowly or sharply together, so as to grip up a snow wrinkle between them, or to thrust them apart, with the toes slightly turned inwards, produces each a different degree of brake, or helps to reconfirm our balance, if we require it.

Small interruptions on the surface should be allowed to pass between the feet. In practical glissading, in fact, the feet are very rarely kept long in one position; they drift gently about, as balance or the surface demand.

The decision as to when they should be kept exactly parallel to one another, with the weight evenly distributed between the two, or when the one should travel slightly in advance, carrying the larger share of weight for the moment, must depend upon the snow surface and angle, and on the amount of work that is being done, in consequence, by the axe. If the surface is roughish and steep or hard, the weight will be more, and for longer periods, thrown back upon the axe shaft, and this for reasons of balance. So supported on the axe, there is not the same risk on a bad surface of our being suddenly pitched outward, head foremost. In such case the feet are best kept parallel and together, acting as supports supplementary to the axe, as upon ice. But if the surface is straightforward in angle and quality there is less threat to the balance, and our object is to reduce the surface friction and increase the pace. To this end all the weight will be brought forward off the axe and kept in balance above the feet. The axe will only be lightly or occasionally in contact with the slope.

The body will be sailing down upright, but on a curve of balance agreeing with the bend of the knees. The feet, in this case, adopt a position and a motion familiar in ski-ing. They remain close together, but one foot travels slightly in advance of the other, carrying for the moment the greater share of the weight. The other foot runs in close support. It is brought up, and in turn passes into the lead, according as ease of balance, steering, or need of rest for the employed leg suggest. The balance sways lightly from one leg to the other as each is employed, and the motion, allowing for the different length of stroke, is not unlike the smooth steady running in long-distance skating. At any second, if the surface demands it, the weight can be thrown back upon the axe, and the feet are then brought parallel again.

Now that ski-ing experience is familiar, it is unnecessary to explain why glissading on one foot—that is, on a single line of contact, with the other foot and axe in partial support and ready to take their turn if required—is easier, quicker and less exposed to accident than moving on the two feet parallel, with the weight distributed evenly between them. The instance of the relative pace and security of bicycle and tricycle, although not quite on all fours, gives us a suggestive comparison.

On an obviously good and continuous snow slope the axe brake can be removed altogether, and the axe is then carried easily in front across the body, ready at any moment to be shot back under the arm into the snow. The body then sways to the balance, above the slight bend of the knees, and is practically upright. This is the most delightful of all positions: there is no tension upon any of the body muscles, and the sensation is that of a winged swoop. To brandish the axe at arm's length over the head, a fashion affected by performers of a theatrical type more familiar in illustrations than on the mountains, adds nothing to the pleasure and diminishes the security. The balance above the feet is prejudiced, and the axe recovery in case of need is slower.

The steering is done, as in skating or ski-ing, firstly, by canting the feet and twisting the toes in the required direction; and secondly, by swinging the weight of

the body into the new position above them, either by means of the sway of balance if we are glissading free, or by the thrust from the axe point if we are axe riding. For instance, if we wish to turn to the right, in order to avoid an obstacle or make a zigzag on a slope too steep for comfortable direct descent, we twist the toes to the right, and at the same time cant the feet in the same direction; that is, we press down the right-hand edge of both boots into the snow, gently or hard according as we wish to make a sharp or an easy turn. If we wish to accelerate the turn, we bring the axe into use, pressing back upon the point, which we thrust into the snow slightly on our right. Similarly, to make a turn to the left, we twist the toes and cant the feet to the left, and, if required, press on the axe transferred to our left side.

Steering.

By making all three movements energetically at the same moment it is possible to execute very sharp turns. The steeper the slope the higher the speed, and the higher the speed the more acute the angle of turn possible.

If a glissader is expert enough to be able to descend steep slopes in balance on his feet alone, without the axe as brake, and has mastered the finer art of travelling upon alternating feet, he can steer his turns also without the axe, and can descend on a succession of sharp zigzags without the small awkwardness involved in transferring the axe from one side to the other of his body. When he wishes to turn to the right out of a direct descent, he sways his balance on to his right foot, directs and cants it, and as he turns brings across his less weighted left foot into line again below it. When he wishes to turn back again to the left out of a zig to the right, he throws his weight on to his heels, as in a ski-ing turn, directs and cants his feet to the left, sways his weight over on to the left foot again, and so continues on the new zag. In travelling on the one-foot method, sharp turns are made by throwing the weight on to both heels; gradual turns can be made on the one foot. Slight changes of direction, not big enough to be turns, are more quickly made by bringing up the rear and less weighted foot, sliding it in front into the new direction required, and then swaying the weight across on to it.

An expert can thus swing quickly and safely down a slope or couloir too steep for direct descent, zigzagging

from side to side almost without help from the axe. His turns are less crisp than those of ski or skates; but he can descend on a snow ribbon or in a narrow couloir, where only short boots could find room to travel or turn.

Even if a glissader has only accustomed himself to descend travelling on his two feet parallel, with his weight evenly distributed between them, he can still make slight changes of direction, without help from the axe, by sliding one foot in front of the other. This will deflect his course correspondingly in the opposite direction: that is, to turn to the right, he brings forward the left foot; to turn to the left, he advances the right. But his turns without the axe will never be effective or sharp until he has learned to glissade mainly on one foot. The second foot, for a one-foot glissader, acts as a free auxiliary to indicate the new direction and to support the turning movement, while the body swings in easy support from one foot to the other, as the turn suggests.

Jumping.

The hands alone should never be used as rudders. Supposing we wish completely and suddenly to change the line of descent, because we see some obstruction below, or discover better snow farther off, this is best done by a half-turn, and a spring on to the free leg. For instance, to get across to our left we swing our free right foot across us to the left until it touches the snow again at its utmost reach. The weight is then flung across on to it by means of the axe, or by a rub with the outside of our left arm against the snow. The left leg follows (all without checking the descent), and we descend on the new line, or swing the right leg again if a second spring is needed. To make these changes of line, a sideways jump across, off the one travelling foot and alighting on the two feet held sideways and slightly apart, is a neater method, but it requires more practice.

Jumping, sideways or downward, is as pleasant a refinement in glissading as it is on ski, and very generally useful. It is often more convenient to jump interruptions, of ice blocks, rock bands and snow humps, than to steer round them. A good glissader jumps off either foot, and alights on both. Even large crevasses can be safely jumped by a skilful man, with a great saving of the time usually spent in circumventing them.

But this requires considerable skill and a discreet eye in selecting the take-off. The edges of bergschrunds are generally hidden or rotten, and the crouch and spring have to be made well ahead of possible breakages. The glissader has no hand-made wall to guide him and to dispatch him on his jump at the right instant, angle and velocity; and the angle of the slope below has not been chosen to accord with his curve of descent on to it, and down it.

If we fall, after a jump or stumble, the first thing, on a steep slope, is to stop any tendency to roll, which is the shortest road to unconsciousness. The next is to get the head up. Then, if we have held on to the axe, we get it by the head and begin to brake, as described above. If the axe is lost, we do the same with elbows and heels, sliding on our back; but never with fingers and toes, face downwards.

There are two methods of stopping or braking, the axe brake and the foot brake, which are used in conjunction for purposes of sudden arrest.

Brakes.

The axe brake is made by pulling the head of the axe upward with the one hand, and forcing the shaft point down, and into the snow, with the other. The weight of the body is thrown on to the lower arm, and the thighs are brought close against the axe shaft. If it is necessary to make a sudden stop on a hard snow surface where one is being 'run away with,' the most powerful brake of all is to bring the shaft of the axe under the right arm-pit, grip the left hand on the head, with the right hand close to it, and turn the body slightly sideways, so that the whole edge of each boot, heel and toe, scrapes against the surface.

The foot brake is made by turning the toes up and shoving the heels in and down into the snow, at the same time straightening the legs. If the surface is too hard to admit the heels easily, or the pace and hard surface combined threaten that an attempt to check with the straight heels will mean one or both legs being torn up underneath the body, so flinging us out and off our balance, the feet must be turned sideways to the slope. The heels at the same instant are thrust downwards, the legs are straightened, and the weight is thrown equally upon the axe shaft and upon the feet.

On any surface where a glissade is justifiable it is

possible to stop with these combined brakes within a distance of a few feet, provided that, as with a motor-car, they are not jammed on so suddenly as to upset the equilibrium and detach the points of contact from the surface.

For gentle checks to pace, touching at intervals with the axe point, or pressing on one or both heels momentarily, is sufficient.

Practically no snow slope of right consistency and termination is too steep to glissade down; but many incline at too low an angle, or are of too soft a surface, to glissade down in a standing position.

Sitting.

So long as we are young and thoughtless, and place the enthusiastic memories of youthful tobogganing before the after-discomfort of wet clothing,—a youth which in the case of mountaineers appears to extend well on into the sixties,—we hail such soft slopes as the recovered opportunity of recalling a lost ideal; and we descend them sitting-wise.

For sitting, the methods of guiding and braking with the axe and the feet are much the same as for standing; only they are more clumsy and proportionately less effective, as the slope also is less exacting. The axe is held under the arm, in the same manner, to brake, and is transferred from side to side to steer.

The foot steering is performed by obstructing with one heel or the other. For a sharper turn, the legs are lifted and swung across in the desired direction. To avoid rolling over in a quick turn like this, the body leans over on the side towards which the turn is made, and the weight is thrown inward and back upon the axe. The whole length of the outside of the leg and thigh contributes to the steering action, as an equivalent for the canting of the feet in a standing turn. Leg and thigh thus supplement the ineffective guidance of the heels. The movement checks the pace usefully; for the snow will begin to hummock under the thighs and up under the jacket, whereas before it was merely percolating through the breeches.

In descending direct the legs are kept together, and the body is converted into as rigid a reproduction of a torpedo as the incidents of descent permit. To accelerate the pace the body can be thrown back and held stiff, which takes off the brake made by the curves of the back and distributes the weight, as on a sleigh or ski. This

movement adds the neck to the other potential snow orifices.

On unwilling slopes, punting with the axe and a swimming motion of the legs can be resorted to, for propulsion; but the effort is not dignified. Shooting, or 'chuting,' head-foremost has an exuberant appearance, but does not add materially to the chances of pace.

Braking is done upon easy slopes by opening the legs, and allowing a triangle of travelling snow to pack between them. To brake sharply, the axe point is driven into the snow under the arm, the body is arched stiffly upward clear of the slope on the support of the axe, and the heels are driven down and in, close together.

For standing glissading, if the surface is good, we generally each choose a line of virgin snow. Pace will come of itself, and is not so important as uniformity of surface. But in sitting glissading the first to descend has the worst place. He has to make a clearer and harder track for the rest. If a trough of this kind is once formed, it will be most polished in its exact centre; and men are well advised to turn slightly upon one thigh and shoot down upon their longest but narrowest available body-surface.

A very pleasant method of descending, as a party, is to form a fashion of bob-sleigh, each man sitting close behind the man in front and having his legs held up by him clear of the slope. The most is thus made of the collective weight and the least of the collective body-surface necessarily in contact with the snow. The best situation is towards the rear of the human sleigh. The man at the head will collect most of the snow pack, and there will be only the usual moist permeations to be enjoyed by the tail.

The first man descending on an unknown slope after fresh snow, or on the occasional snow patch found at lower levels, should always make careful examination to see that there are not rock or stones near enough to the surface to inconvenience, if not injure, his descent.

Sitting glissading is useful not only on snow too soft or too easily inclined for standing, but also upon surfaces where a crust has formed over soft snow, through which the feet break under any attempt to glissade standing. On snow of this character both steering and stopping are even more difficult than they are

in ordinary sitting glissading, since any attempt to drive in the heels suddenly may result in a head-over-heels fling. On such a surface it is best to lie as flat and stiff as possible, and avoid making any abrupt local movements.

The sitting glissade has been already mentioned as of use in crossing schrunds with awkward-angled or dubitable bridges. Each man before he shoots for the bridge should make certain that he leaves enough free rope and good sense behind him to allow him to come to rest on the far side without a disruptive or a premature jerk.

Stone Tests.

It is always wise, before glissading on a slope of uncertain consistency, to throw a few large stones on to the snow to test the surface. They should be as heavy as possible, so as to ascertain the weight at which the snow will avalanche. The practice has the further advantage, on a slope whose termination we can see, and where, therefore, a slight avalanche quality in the snow need not deter us from glissading, of clearing away all the deciduous snow from at least one line of descent. There is left a smooth, harder track whereon a human being can descend comparatively dry. At the best, the stones may start a general avalanche, and so leave a safe and clean slope where we can choose our line. Incidentally, the stone track serves to discover the presence or absence of concealed stones or of rock points uncomfortably near the surface.

The Rope.

To remain roped is impossible in ice-glissading, and is a nuisance in snow-glissading. The rope should never be necessary where there is any long and comfortable glissade in safe prospect. Pace and real foot-running are impossible on the rope. Its use enforces axe braking and slow-coach running at even distances, so that the rope shall neither tighten upon the front man and upset his balance nor entangle in loose coils about his feet. Every one in a roped party, however expert, must be axe braking, and wearying his shin muscles, if no more, in the vain effort to keep an even distance over surfaces of quickly varying quality and angle.

For the men in the middle of a rope, to be thus glissading is simple weariness of the flesh. On short glissades, during long climbs, the rope may have to be

retained to save time, but on slopes of any length it is always worth while to unrope. If the rope has to be retained on such slopes for precautionary reasons, because the end of the slope is not in sight or because there are beginners taking part, the party should rope in pairs. Two experts can glissade fairly freely on a rope by descending on adjacent parallel lines with the rope loosely across between them. They have only then to see that it does not catch on excrescences which they themselves are avoiding. In the same choric fashion an expert can glissade alone with a beginner, protecting him and accommodating himself to his uneven descent. He follows beside or slightly behind, and is at liberty to quicken up, overtake, and even get secure anchorage in time, if he sees his companion beginning to descend the slope in other fashion than on his feet. In glissading with a beginner on a rope the pace should never be allowed to become greater than one is absolutely certain of being able to regulate, not only for oneself but for one's companion, with plenty of margin for accidents. Once a man has been jerked off his balance, it is far harder for him to stop himself and his companion by the travelling axe brake, on a steep slope, than when he is stationary and upright with his heels well in. He must therefore keep the pace well within the speed limits.

The higher refinements of glissading, the zigzag and the free sailing on one or both feet, are of course out of the question for more than two on the rope; and barely feasible for them.

Some Variations. There are a few occasions where exceptional varieties of glissading may be found of use.

Alternate Glissading. In descending snow slopes of doubtful consistency, or slopes or couloirs whose lower end is concealed, and therefore an object of suspicion for free glissading, an alternate slide and anchor method can often be adopted. It is especially good for protecting beginners who cannot be relied upon to arrest their glissade at any given instant. The experienced man anchors firmly in the snow with the rope round his driven axe. The front man then glissades down until he is arrested by the rope or a call from the rear. The rear man follows, and glissades

either down to him or past him, stopping himself in the latter case, if he is wise, before the rope runs out. *If* he is wise, because no inexperienced man can be relied upon to know what security of anchorage is required to resist the jerk of a man running out a double length of rope on steep snow. The first man then, in turn, glissades past, and is stopped by the expert with the rope. The process can be repeated until the bottom of the slope is reached, or the secure termination of a freer glissade is ascertained. The method is a good time-saver, especially in steep couloirs, but it must be worked with all caution. I tried it on one occasion with a mountaineer of confident self-security, and after sailing past him, and becoming certain that my rope must have run out, I turned round, to see him head-foremost after me down the slope. He had been twitched from his stance without so much as a perceptible check to my rope. Since then I always, in alternate glissading, turn face inward when I feel the rope is near its end, and stop myself,—for the first few 'runs-out' at least, until I know I can depend on my second. With a beginner it is best to stop, as last man, when one reaches him. With a good second it is enough to arrange with him that each shall call out sharply to the man glissading some three yards or so before the rope runs out, leaving him time to stop himself.

Face Inward.

Any man who wants to get all he can out of the opportunities to glissade must be able to travel in every reasonable attitude, and to change from one position to another at any instant without check or loss of control in the movement. The axe is the transitional support during all movements involving sudden or marked alteration of balance. As a convenient variety it is useful to be able to glissade face inward toward the snow. On slopes of doubtful termination, and in couloirs more especially, where it proves impossible to discover if there may not be some 'cut-off' below, or where the quality of the snow, and perhaps the presence of ice beneath it, make caution imperative, a more controlled, watchful and restful descent can be made with the face towards the slope The axe head is then gripped under the arm with the pick caught behind the shoulder. The two hands are firm on the shaft in front, ready to shove the point

into the snow. The legs are slightly apart, with the feet parallel and the toes inclined upward. The descent can be stopped in an instant by pressing on the axe shaft, and by forcing the toes outward and downward, so that the inside edges of the boots scrape downward against the surface. On rough icy surfaces, in order to allow us to look round, and also to prevent the toes catching and throwing the body outward, it is sometimes even safer to bend one leg up, so that the flat of the one sole rests against the slope at about the level of the knee of the lower straighter leg. The body then lies forward over this bent leg as on a firm spring, with the centre of gravity low and the balance secure. The head is freer to turn and prospect above or below. A foot brake of extra power and rapidity can be made by scraping the upper, raised foot downward along the slope with the whole force of the body—a sort of stopping kick. For hurrying the descent of awkward couloirs where the glissade of short stretches may have to be stopped within inches, I have usually preferred this face-inward glissade. In this position we not only can stop, but steer with great precision and power; and in a very confined space, as in a narrow couloir, we can side-step or side-jump easily. To jump obstacles or crevasses when glissading face inward, we must of course turn round first; but a good glissader should find no difficulty in twisting round, especially out of the last position described, with the one leg raised, which is in itself already a half-turn attitude.

The position has the additional advantage of allowing us to watch companions above; and, in suspicious couloirs, to keep a look out for their loosened stones or small following avalanches. Stones can be dodged once they are seen; and a fine face-inward glissader, whenever he sees the small, wavering, pursuing avalanche, looks round and ahead for some lower bay of shelter in the walls of the couloir, and, if need be quickening his pace, steers out of its way into safety at the edge.

Plunging.

In couloirs or on slopes faced with soft sticky snow, too soft or too gradual for a free glissade, it is often possible to save a long trudge of descent by using the 'plunging' step. A few long springing steps, driving the heels hard along the surface, will start a small surface snow slide, and upon this we

can ride down, until it again packs, when the plunges are again repeated. If the snow joins in the game too heartily, and there is a risk of losing control and of being swept down in a cumulative avalanche, we use the swinging cross-step to the edge of the wave, and jump clear. When the avalanche has passed there may be a fine surface left for normal glissading.

On every slope where we begin to feel that the travelling mass of accompanying snow is getting beyond control, the glissader must be ready to swing-step or to jump clear of it on one side or the other. When it is past, he has also to look out for the not infrequent chance of the furtive slides which will pursue the first. If two men are glissading on a rope, the upper will be in the best position to decide when the mass is growing too big, and he must give timely warning to his companion before he jumps clear himself.

On Claws.

In couloirs of a certain type, where there is a thin covering of fresh snow over ice, or where snow has partially melted into ice glaze over rock, I have occasionally found light claws a great help to safe glissading. The angle may be too steep, and the snow upon ice too bad to allow of a prospect of descent without prolonged, deep step-cutting or slow ambling on our prehensile claws. A pair of light claws that one has no fear of blunting may then be found of great service to save time and labour. Glissading lightly and slowly on the feet, side-crouching as upon ice, or still better face inward, the claws slip down with the surface snow. Where the snow is thin, they scrape through on to the ice and retard the pace; where it thickens, they can still be forced through by throwing more of the weight off the axe on to the feet; and the descent, with the fitful brake of the axe, remains perfectly controlled.

As before noted, claws of the long-pointed pattern can be used in the same fashion on rotten ice.

On hard, smooth ice at high angles, claws of the light type are often safer than nailed boots. A good position for such claw-glissading is one of those familiar in skiing. We sit astride of the axe shaft with the point against the ice. We can then throw the weight back upon the shaft, and brake, while we release the feet to steer, or we can let the weight forward on to the feet and

increase the pace. Either or both feet can be relieved of the share of weight if anything threatens to catch them and upset the balance.

This axe-riding position is occasionally convenient in icy couloirs, or on fresh snow, where only an absolutely slow and controlled glissade would be safe.

It can also be made use of on very rough surfaces, on dry glaciers or practice ice slopes, without the extra security of claws and trusting to the boot-nails alone. But on nails alone the glissade is proportionately less regulated, and we are more dependent upon the axe for control and braking.

On Other Grounds

Many surfaces other than ice or snow give us good practice and pleasurable moments. Volcanic ash is said to provide the finest conceivable flying footing. Sand of sea-cliffs or quarries, and even the mud shoots of the east-coast cliffs, give excellent fun; but the most common, and perhaps the most admirable sub-alpine surface is a light, steep scree slope.

Our method of descending these shoots is dictated by the size of the stones composing them. When they are of shale, or light enough to slide away under our weight, we need only straighten the leg, stiffen the ankle, incline the body slightly forward from the hips, and start with a long leaping stride, forcing the heels well down and in. Small scree, at a good angle, will carry us on and down of itself. The axe is held in the same way as on snow, and is only used for balance touches.

On Scree.

On scree at a lower angle we shall have to continue the plunging strides, leaping from heel to heel and travelling as far as possible on the stones set moving by each foot. The stronger the leg the longer may be the stride. The massing of the stones under the foot will stop each step with the softness of a slow spring, and if we are thrown out of balance by one too abrupt foot check, we can generally recover it on the next stride.

Towards the end of the slope the scree grows larger, and whether sliding or plunging, we have to look out for knee and ankle twisting. We go cautiously, but

driving always harder with the heel, until the stones refuse to yield to the thrust; and then we call in our loose legs under control, and proceed to stumble or dance down the rest according to the perfection of our ankles and balance. A man light of foot and supple of joint can let his feet drift, as it were, over even large rolling stones, letting them adjust themselves to the varying resistances without checking his pace. A man who judges his scree not by its size but by its angle, its shape and the way it sits on the surface, can continue his glissade often well beyond the point where the less expert begin to fall or crawl.

Once the blocks grow too big to be kicked into harmless motion, and the drifting feet begin to slip over them into the interstices, the wise man begins to look for other shoots to carry him farther. By using the swinging cross-step described already, we can make diagonal descents of slopes on a succession of connected parallel glissades. By choosing a line well ahead, and crossing from shoot to shoot, many hillside descents of weary prospect can be charmed into a few moments of stimulating racing. It is well to remember that up-running spits of light scree often conceal themselves in depressions between ribs of rock or in hollows between slopes of heavier scree, especially near the bottom of the slopes.

The light screes that lie in these lower furrows on hillsides are among the deepest and pleasantest. Our zagging from furrow to furrow will divert our thoughts if not our feet from the last tiresome steep grass drop. Where the lower spits of light shilla thin out, generally at their lower ends, it is wise to look out for the catch to the ankle of rocks or wet earth or grass, stripped of their scree varnish by the driving heel.

It is best for each member of a party to choose a different line, otherwise the larger stones dislodged, often accumulating a torrent, may surprise a speedier forerunner. Similarly, it is safer to leap sideways occasionally ourselves, and wait while our own attendant torrent passes.

The angle of inclination at which small scree lies is invariably the angle of disinclination for big scree. Big scree, when we cannot avoid it, is an unqualified worry, and we worry out of it as we can. The method, tra-

ditionally recommended, of sitting or standing on one large stone and tobogganing down on it over the others, would seem to be only successful for distances not yet ascertained.

Except in the North, where winter snow gives much the same conditions for glissading as the summer Alps, winter glissading in Britain is usually upon snow-covered scree or mixed snow and scree. The end of our glissades in this case has a special risk: where the snow thins and weakens among the larger blocks, which it yet continues to cover—to our downfall. To glissade near emerging rocks is risky, on account of the probable holes and hidden pockets in the snow round them.

In Winter Gullies.

In gullies alone we find snow over rock. Here there is another special risk in the rock steps or pitches, which may be only partially covered with snow. The drop is often invisible from above, and an inexperienced glissader may be unable to stop himself in time, when he is close enough to recognize a break in the continuity of the snow slope. Sometimes there is a frail lid of snow more deceptive than an open break; and I have seen a man shoot over a pitch of this sort through the snow lid and down the wet rock channel under the lower snow. Where the rock of such pitches is visible, we have still to look out for another trap. We may count upon stopping as we reach the rock; but the very end of the slope, where the melting snow has run down and refrozen over rock, is usually of harder surface, if not of ice. Hence we have to allow for a sudden and surprising acceleration just where we intended to slow up.

No man should start glissading down a gully or slope that he does not know; or that he cannot see throughout its whole length; or until he is expert enough to know what the snow, as he finds it, will do with his feet.

Glissading is also possible and pleasant on slopes of grass, heather or whortleberry growth, if the angle of the hill is steep and the conditions right. Under snow, even in small quantity or half melted, any herbage will serve; but the dry, polished, almost glassy surface of grass or short growth, produced by drought or hot sun, is almost as slippery as snow.

On Grass and Heather.

On firm covering snow over hill grass, of course a standing glissade is indicated.

If the snow is soft or thin, so that the feet would catch through it upon the grass or heather stems, sitting is best. On steep slopes sitting means rapid going, while there is any snow at all showing between the stalks.

If the snow is merely a wet skim, or if we are glissading upon dry glassy herbage, it is better for clothes and comfort to use the feet. The correct method is to sit or squat right down on the heels. If we have an axe or stick, we lean back upon it, or push with it, as balance or our relenting pace suggests. If we have no stick, we clasp the hands round the knees and shoot down in a honeypot attitude. At a check, the legs are shot out, and a raking action of the heels starts the slide again. This fashion of sliding crouched upon the feet is feasible upon nearly all steep slopes of smooth, thick, fatiguing herbage, where the walking descent would be slippery and laborious; but it must be used with caution. Stones, roots and hummocks intrude; and nowhere is a human being more helpless, once he has lost control, than on steep, slippery grass. If he once starts to roll, a broken arm or a bad shaking may be the least disagreeable consequence. There have been more serious accidents due to slips on grass than on all the snow mountains of the world put together.

CHAPTER VIII

RECONNOITRING

RECONNOITRING precedes in action the exercise of mountain craft. But as an art it is the gold cup in the sack mouth of a mountaineer's equipment. Its effective mastery must rest upon his previous accumulations of practical experience. It may therefore, fittingly, be put in last.

In the Alps and nearer European ranges, maps and guide-books relieve the mountaineer of almost all occasion to apply his powers of observation to the interpretation of the Seen or the reconstruction of the Unseen. The majority of men who climb in the Alps or Britain get no practice in making even elementary deductions from scenic details within sight; and a number more, whose experience and observation have been sufficient to enrich them with what they would call an instinctive feeling about the meaning of topographical details which they can see, or about the probabilities of those which are out of their sight, have never, for lack of opportunity, been forced to resolve this feeling into precise conclusions.

Nothing but actual necessity, the need of providing for safe progress or comfort, will induce most men on a holiday to exercise or educate their observation. The loss is considerable; not only because a developed faculty of observing, and of reasoning from the observations, is in itself a valuable permanent possession, but because the neglect involves the failure to see much that is beautiful. If we are accustomed to wait until beauty imposes itself upon the eye, as in the end it will, and almost flauntingly, in large mountain scenery, we shall have already missed the discovery of the relations of line and colour and mass to which the beautiful effect is due, and we are fated to overlook much that is lovely and much that is interesting in regions where there is

MOUNTAIN ARCHITECTURE [C. F. MEADE

grace and interest in the smallest detail, but where detail escapes unperceived among the broad and salient features of familiar magnificence.

On a more material plane, a man who aspires to lead a party must be able to 'see,' in the sense in which an artist or natural scientist 'sees,' and he must be able to make the necessary mountaineering deductions from his sights. A mountaineer who wishes to conduct an expedition efficiently in unexplored ranges must be able to do more: he must be practised in the art of confirming conjecture as to what is beyond his sight from 'signs' within view. For an expert of this sort it is fortunately sufficient to indicate what he can discover and how to set about it; fortunately, because 'signs' in practice are so modified by place, climate and season that no rules could be laid down without a page of exceptions to prove each one. One day of practical demonstration under guidance will reveal more of what we ought to see and how to see it than much tabulation. We may write of a 'snow sky' and an 'ice sky,' and a mountaineer who had them pointed out to him would recognize the difference; but we cannot with truth say "a snow sky is a whitish-blue, or shows as a white underside on a cloud," or "an ice sky is a greyish-blue, and reflects in a shade of grey from a cloud," because a different climate or region might anywhere contradict our colour definitions. But the distinction between the two would remain as a constant difference of tone under all identical conditions, and it would be perceptible to a trained eye.

Somewhat the same difficulty interferes with any accurate summary of more elementary signs to be looked for in reconnoitring,—signs whose discovery is, or should be, part of our daily alpine routine. Every mountaineer should know at a glance, in the right conditions of light, new snow from old snow, ice from crusted snow surface, open glacier from *firn* or *névé*. But who could learn to recognize the differences, under continually changing conditions of light, from his recollections of a written classification? The suggestions here made must be understood, therefore, only to affirm that between certain groups of surface appearances there are certain constant relative differences, whose presence, or absence, can always be ascertained in the

right weather and light. They are intended to indicate a few lines of less obvious investigation, which the trained eye can pursue in examining aspects and details of mountains that are visible to everybody but not equally intelligible to everybody; and further, to outline a province of yet more difficult discovery—the collection of information as to aspects and details which are not even in sight.

It may now be assumed that until a mountaineer knows something of his craft by actual experience, the choice of a route up a peak need not be left to his unaided attempts at reconnoitring. Elementary mountaineering information is far more widely diffused, and practical climbing ability has become almost an inherited instinct. The method adopted by the Badminton on Mountaineering, and by various excellent manuals in imitation of it, first synthesized for us a sample peak or climb, resolved the attributed features into their simple elements again, and then directed us, with natural confidence, precisely how to deal with them. A method advisable for purposes of picturesque propaganda in earlier, darker days is of less service to a climbing generation whose acquired craft can be more generally trusted to know how to attack its peak, if it can once attain to only a small part of the certainty about the real character and the momentary condition of distant detail which these illuminating studies could happily assume. The path so well prepared by our predecessors for the straying or reluctant feet of the potential climber, and so entertainingly bordered with composite examples, need not be retrodden. Guidance in reconnoitring, to be of later use, must now wait for its opportunity further along the way, and be ready to pester the progressive competence and self-assurance of zealous mountaineers with the well-meaning but aggravating importunity of an elder walking companion: "Can't you see *that*?" and, "What does it *mean*?" and, finally, "Well, then, I'll *tell* you!"

Snow and rock and ice, as a triune element, alone concern us. What we need to find out about them is their respective *angles*, to know if we can get up at all; their several *conditions*, to ascertain if we can do so with or without danger or difficulty; and the degree of

modification which their *combination* may be introducing, in order to decide if we can do so within the appointed time. For instance, our agreeable opinion of the angle of a rock rib will counterbalance our unfavourable view of the state of a snow face, which it relieves; or our optimistic impression of the snow in a couloir will free us from the gloom created by our sight of the angle and character of a rock wall, which it bisects. With a peak as such we are only concerned in so far as it presents to us a greater or lesser mass of favourable or unfavourable angles and superficial conditions. We take it that our climbing craft can get us up any mountain by any way visible or invisible. It is for our reconnoitring craft, first, to reject those alternatives which are interrupted by the angle of the impossible; secondly, to condemn the lines where it detects surface conditions or direct menaces which will introduce too large an element of danger; thirdly, to except the routes where it decides that harsh angle and poor condition in unrelenting succession combine to form too great a volume of difficulty to be humanly vincible in a single expedition; and lastly, if no agreeable or interesting remainder be left over, to use its utmost skill to determine whether some *unseen* aspect may not reveal sufficient of its character to encourage a hope that it will offer a more helpful line of attack.

The sum of the results of these investigations will of course add up differently with every peak, and any discussion of it in the abstract could only be hypothetical. The decision as to whether this sum in any concrete case represents a feasible or justifiable mountaineering attempt must take into further account the strength of the party proposing to make it, and must be therefore, for us, equally hypothetical. All that the grammar of reconnoitring can usefully define are the lines which investigation should follow in order to secure exact information about the elements which are the material for our calculations, and therefore the chief factors in our decisions. Snow, rock and ice are these elements; and their state, angle and influence upon each other in certain combinations form the only matter that need concern our examination on the spot,—or here.

Things Seen

To discover whether a distant slope is snow or ice, if the character of the surface is not apparent at once, or deducible from its position, aspect or angle, we must wait for sun or strong daylight.

Snow Surface Condition.

Ice surfaces—that is, the smooth ice surfaces found in the Alps—reflect light as an even, steely glimmer, like elongated pools of water. Black ice, not so often found in the Alps, has a different quality in reflection. Granular ice is distinguishable by its reflection of light in facets or prisms. It will be noted that these tend to increase in size as our inspection descends the length of a glacial slope. The honeycombed ice found in tropical ranges is quite distinct in character; it can be recognized from a distance, and in a photograph, by its surface forms.

Snow surfaces show plain white or grey in comparison.

An ice crust upon snow has an appearance much like that of ice, but the reflected light is 'pockled' and uneven.

New snow, which is best left alone, has a brilliant fresh surface. Seen even from great distances, and especially upon rock, it shows a filmy, gossamer, veil-like quality. This endures until the aeration has escaped and the feathery surfaces have subsided into harder contours.

Old powdery snow, as contrasted with new snow, has a greyer tint when seen from a distance, particularly if not seen in direct sunlight.

Old wet snow, laborious to cross, and deciduous according to its angle, shows a bluish, luminous surface light, especially in its depressions. It is often transected by visible lines of strain or cleavage.

A thawing snow surface, seen from near, is dull and drenched looking, or pitted with small holes.

Surface hard-crusts, or plates, produced alike by wind and sun, which afford pleasant going but possess the avalanche potentiality if the angle is steep and their attachment to the surface below is slight, generally mark themselves off from the surrounding snow slopes by a lower, duller tone; sometimes they are tinged with a yellow shade. The plates vary in thickness, deepening towards the middle, and they can often be

recognized by their edges, which run out on the neighbouring snow in darker wavelets, sometimes with eyebrow-markings round their curves.

Old hard snow, of deep attachment and sound progress, lies in alternating wave and hollow of different tones of light and shade, where the sun has been at work on the surface. It is often dust-speckled, or shows bluish finger-prints.

Granulated snow, in strong light, may show bright or prismatic reflections from its facets, similar to, but easily distinguishable from, granular ice prisms.

As confirmation, or correction, of what distant observation may have revealed about the character of ice or snow surfaces, general considerations must also be taken into account: the recency of the snowfall, the subsequent weather, etc. There is also the final test of touch, which is made on the spot, before any snow slope is traversed. The change in the condition of the snow, which may be produced by a day of sun before we can return down the slope, must not be left out of the calculation. Many slopes whose surface may be adjudged and found safe for passage in the early morning cannot be trusted by nightfall.

It is essential to be able to judge of the inclination of a slope; for some harmless conditions may become dangerous if the snow is lying at above a certain angle. New snow, for instance, has been known to slide at as low an angle as twenty degrees. Hard old snow, melted and refrozen, may be supported in small patches, and remain reliable, at as high an angle as sixty degrees.

Angle on Snow.

The power to estimate the angle of a slope by the eye only comes with practice. Most slopes look precipitous in face. But a mountaineer who has trained his eye by first going round to see a number of such slopes in profile, and by then returning to see them in face, has learned what he must deduct from an apparent angle. He is then qualified to make a truer estimate of the real angle of slopes which he may be able to examine in face alone.

Snow cannot lie at anything like the angle at which it often appears to lie when seen in face. From the presence of snow, in fact, much can be argued as to the generally mild angle of the mountain face on which

it lies. Except in narrow couloirs, where it is supported by the walls, snow does not lie permanently above or even up to an angle of fifty degrees. Most big snow slopes are considerably less. The broader the face on which it lies, usually the less the real angle of the snow.

The fact that a big snow peak presents a continuous slope of snow to its summit is evidence that the mean angle of the ascent is not great, otherwise the even accumulation could not have proceeded. In prospecting a new mountain, therefore, however tempting its rock face or ridge may be to a modern climber, its snow side, if it has one, may be assumed to offer the inclination of easier ascent. And this more particularly if the snow slopes face towards the south, where the snow would naturally adhere least to the face.

Interruptions to climbing on such snow faces, whether as steeper slopes of snow or as ice walls (such as it is well to note beforehand), are at once apparent from their different shading if the snow slopes are inspected when the sun is overhead.

The inclination of a hanging slope of snow always appears still more exaggerated as seen from in front if it lies on the face of what is mainly a rock peak. We have in such case to discover if the snow is lying on ice, or only forms a coating to the rock. If it is on ice, the lower edge of the slopes, where the snow runs out on to the rock, will generally betray a rim or broken wall of ice. To judge of the quality of such a snow surface, and of the strength of its attachment to its ice or rock sub-surface, the slopes below it must be examined, and snow, stone or water furrows looked for. By the crumpled or the clean appearance of the edges of the slope itself, where it touches the rock walls on either side of its descending fan, much can be learned of its past transmutations and present condition.

Long or short spits of lighter snow, running up against darker snow or ice, are the retentions of later falls, and are indications of uneven angles of surface. They betray the presence of bulges or ribs below, and, besides their promise of easier progress on slopes where the general surface may be frozen hard or over-steep, they give us by their contrast a further basis for our estimate of the actual inclination.

The presence, the shape and the number of cleavages

or crevasses in a slope of ice or snow are a further guide to our estimate. A certain type of crevasse is only found on slopes lying at an angle of about forty-five degrees.

We may get additional evidence, in cases of doubt, by waiting for the sun to throw the shadow of another peak or shoulder upon the slope. When the sun and the interruption are located, the distortion of the reflection will allow of an approximate estimate of the angle of the snow slope.

Faces or ridges of mingled rock and snow, and surfaces interrupted by the intrusion of any detail, be it only of a shadow or tint, are always easier for the experienced eye to estimate, in angle and character. Where we have rock and snow or light and shadow in contrast, practice in the reading of snow and ice surfaces, and in the rules that govern their angles of inclination and attachment, and practice in the interpretation of the details of rock structure, become mutually and comfortably corrective.

Snow Cornices.

Cornices form against the wind, not with it. The contrary is sometimes stated; but the error is possibly due to the fact that irregularities in the configuration of a ridge often produce back eddies in a cross-wind. If the prevailing wind is snow-bearing, and across, a snow-bearing back swirl may build a small cornice on the sheltered side of a ridge. Such a small cornice would appear to have been formed *with* the prevailing wind: actually it would have grown against its return eddy. A wind blowing along (not across) a serrated ridge may similarly produce very small cornices facing *either* way on the ridge, and apparently at right angles to the prevailing current, owing to some tower or curve on one side or the other having created an inward and upward cross-eddy, and a shelter from the main-current in which the snow-laden eddy can work. Large cornices facing either way on the same ridge, and the double cornices, are produced by a shift in a snow-bearing cross-wind to the directly opposite quarter. If we find ourselves on a corniced ridge when a strong wind, and especially a strong wind from a warm quarter or with Föhn in it, is blowing against the back of big cornices, i.e. from the opposite direction to that from which the snow-bearing wind was

blowing which formed the cornices, we have to be even more careful, if that be possible, in dealing with them, as such a wind will loosen their attachment and magnify the suddenness and the size of their collapse. A cornice will always form more easily on the summit of a sheer or abrupt wall, which creates a strong upward eddy in a wind blowing against it, than upon a more gradual or snow-rounded inclination which offers less resistance to the current and less 'catch' to its snow burden. For this reason, upon a summit or a ridge which has, as so often is the case, one more gradual snow side and one rock side inevitably steeper, we must be prepared to find cornices overhanging the rock face, larger if produced by a wind-shift, lesser if by a back eddy, even though the prevailing wind has blown regularly upon the opposite snowy face, and should have relieved us of the necessity of caution by its failure to develop cornices on that side.

In general, therefore, the direction of the prevailing wind can give us no certain guidance as to whether or not to expect the existence of cornices. If a snow-bearing wind has blown against the visible side of our ridge or summit, we shall see them. If upon the invisible side, we must assume their presence until we can disprove it. But a wind-shift or variable current may always contradict our calculations. A cornice is very quickly built.

If we have not been following the performances of the prevailing wind, or if we mistrust its portent in any case, we have to rely upon visual evidences when we are prospecting the approach to any snow summit or the traverse of any snow-crowned ridge. In the case of a single summit it is less trouble to assume the presence of a cornice, until we fail to find it. In the case of a continuous ridge it may save us much tribulation to ascertain its condition in this respect before we start out for a long day upon it. If there are cornices, and they project *towards* us, they will at once be recognizable; if *away*, it is not always easy to make certain, without getting a sight of some part of the ridge in profile. Their detection at one point of a ridge will dictate the necessity of precaution along the rest. A telescopic examination can often discover the thin dark line of junction or strain, running parallel to the crest in the snow on the near side, where the projection of a cornice

towards the far side starts its inclination. (In more considerable snow ranges, such as the Andes, this crack has, I am told, on occasion been proved to be due to a longitudinal crevasse on the ridge. In the Alps, however, I know of no case of this having been observed.)

An alternative and rarer indication will be the discovery of a band of shadow or duller tint, seen in the right light, running along the snow wall just below some part of the crest. This will be due to a relative steepening of the snow wall, sometimes even taking the form of a concavity, where the back of a high, steep cornice, facing towards the far side, hummocks up off its supporting ridge. The appearance I believe to be occasioned by a fall or a shift in the prevailing wind,—a fall permitting the snow to accumulate upon the head of the cornice and form a sort of bulbous whale-back over it, or a shift of wind to the near side beginning a projection which may ultimately grow into a 'double' cornice, with the higher of the two facing towards us.

Failing either of these signs, any two projecting points of rock or snow, near together on the suspected ridge, should be examined. If the connecting line of snow between them shows sharp and continuous against the sky, and ascends at its either end in a continuous single curve to the points selected, the cornice on the far side, if any, will be slight and local. If, however, the snow rim seems to merge indefinitely on the skyline, and its curve ascends to the points at either end in a variable arc of different centres, so that we seem to see, as it were, round the edge of a fold where the snow-curve hangs to the rock points, a cornice is indicated. If the breadth of the points or towers is sufficiently ascertainable to enable us to estimate the average thickness of the connecting rock ridge hidden below the snow between them (as it usually is unless the towers are seen absolutely flat in face), then the look, almost a reflection, in the sky immediately above the snow curve, and the character of the snow curve where it wavers over against the sky, will indicate to an expert eye whether the cornice is large or small.

Where, again, sufficient rock points projecting from a snow ridge are visible, as we see it in face, to suggest what must be the actual line of the snow-covered rock connecting them, any wayward sweep away from us in

the visible line of the snow between them is an indication that the snow rim, where the skyline thus unaccountably retreats from the eye, is superintending a cornice on the far side.

The presence of a double cornice—the fatal cornices that face two ways, one built up above the other—is not difficult to establish. A band of shadow or low light on the near side of a snow crest, below a band of higher light, means a lower cornice facing towards us under an upper cornice curving away. A band of markedly higher light, below a band of shadow or obvious concavity, means an upper cornice facing towards us above a lower cornice facing away.

For all such observations on snow, which find their opportunity in the relative positions of light and shadow, it is apparent that a time must be chosen when the sun shines from the right quarter. Their accuracy depends upon their being continued over a time sufficient for the sun to travel past, and so indicate to us dimension, by the change in, or the disappearance of, the shadows cast.

Wind and Snow Signs.

Wind is not 'seen,' but its immediate effects upon snow are, more especially on high ridges, corniced or otherwise. The quality and quantity of the surface snow on a ridge, which it is important to know beforehand, can be discovered in times of wind from the amount and direction of the snow particles, which are seen to be blowing off the ridge, and appear as a film or puff of vapour upon the sky just above. The absence of any halo to the ridge, in spite of the manifest action of wind upon adjacent clouds, is equally valuable evidence of the stable quality of the snow.

The direction and force of the wind will often suggest the side of the ridge to which we shall prefer to limit our passage on the morrow. On the windy side, if the ridge be snow-covered, according to the quarter and character of the wind, the snow will be crusted or hard, or we may have to encounter a bare sheet of ice. If it be rock, again according to the wind, we shall find the holds either cleared or ice glazed in the morning. On the side sheltered from the wind, on a high exposed ridge the snow should be just of good quality. But even on such ridges it may be spongy and cantankerous if the wind has had Föhn in it.

In a bad season, or after a storm of 'dry' snow, it is

worth while examining high ridges that have been exposed to the wind, on the chance that they may not have been closed by snow for the usual three days, like other peaks. A friend and I owed our own last great climb to having observed that the Zmutt ridge of the Matterhorn had been blown black and bravely snow-clear by the same storm that sheeted all the other ridges and summits of Zermatt in white, untimely mourning.

Apart from the indirect evidences it brings, wind, keen or warm, gusty or continuous, has its direct bearing upon the comfort, the safety and even the possibility of our climbing. Of its effects on snow surface, on rock falls and upon *morale* I have written elsewhere.

Ice sheets on snow peaks are located from a distance by their reflected light; but it is well to memorize or sketch their position and extent beforehand, especially if we expect to have to cross them upon our descent, since they will be usually invisible from above. If there is prospect of our glissading, the exact positions of interruptions, ice shields, bosses, etc., must be known in advance.

Ice.

Ice upon rock is apparent, either as a grey-blue, bottle-glass bordering to the stippling and nestling of old snow, or in the refrozen festoons of new ice, exquisite and evil, that complete the Gothic character of granite pinnacles.

Lazy, main glaciers reveal themselves frankly. The solution of their complexity is the business of ice craft; but distant inspection is concerned to discover the easiest line of ascent or descent, if the glacier is to form part of the expedition.

The most difficult hanging glaciers—that is, those with the largest systems of crevasses—will be as a rule the most steeply inclined. They will be therefore the easiest to prospect, even in detail, as seen in face from far off. Very few hanging glaciers descend evenly or straight. Either side or the centre will be moving the faster, and receiving the fuller reinforcement. The line of the great crevasses will slant upward or across, from one side to the other, or from both sides to the centre. And along the edges where the lines of varying pace and pressure adjoin and descend in conflict will be found, if there are no abrupt ice falls due to uneven bedding, the least interrupted route. Contrary pressures often tend to

squeeze up the ends of successive cross-lines of crevasses, creating a tortuous but consecutive eddy of passage. Though the crevasses may still exist, as walls, *séracs*, etc., they will be more compressed and negotiable on this line. Frequently the cleavages will here survive only as partial splits, and across and down the edges of the unsevered splinters or flakes a continuous descent will be possible. But climbers may skirt round the mazes of glacier causation, if they have but eyes for the visible surface clues. It is enough for them to note from afar and remember by marginal marks where the best line of traverse from side to side, or from side to centre, should be started, in order to keep or recover the mobile thoroughfare. On large glaciers this is often very difficult to rediscover once we are on the ice, when our view is restricted by its irregularities of surface.

Similarly, to enable us to get on or off any glacier, we should note beforehand the position of convenient side-bays, where the ice runs out on to the rock in smoother, spent waves.

Even as the passage of couloirs might be considered as belonging to snow and ice craft or to rock craft, so also their consideration is transitional to rock reconnoitring.

Couloirs.

On large mountains the important thing to know about a couloir beforehand, if we intend to use it, is whether it is filled with ice or with snow, and whether it is subject to stone fall.

To information on the first point, the study of the angle of the couloir is the first help. A steep angle generally implies that the lining will be ice and not snow.

But as snow, supported by retaining rock, may remain at a very high angle, we look to see if there are any furrows in the white surface. If there are furrows and they are in ice, they will show us ice reflections in sunlight. If there are no ice reflections and they are therefore in snow, or if they are only ice-backed and therefore in snow-covered ice, the depth of the furrows will tell us what depth of snow we may expect upon the ice. If there are no furrows, the edges of the supposed snow must be inspected for further information. Where the snow runs out on to the rock at the side in ice webs, the surface tone will appear of different qualities if it be snow on ice, or if it be ice throughout.

And after all our examination, we may be agreeably surprised to be able to ascend on hard snow in the early hours where we had calculated from the angle that we should be hacking in snow-ice ; or as disagreeably disappointed to find snow of avalanche quality, on a late return or after warm wind, where we had located snow of the best bearing variety during a morning inspection.

The base of the couloir should be inspected for traces of previous snow avalanches, and for the character of its bergschrund. We see if we can whether the summit of the couloir is commanded by glacier or slope likely to use it for the discharge of snow or stones. If so, we note during what hours the presence of sun will increase the risk, and when shade to diminish it may be looked for.

In a big couloir we mark down islands of rock which, in case we are detained in the recesses until stone fall time, will provide us with screens below which to steer our line.

We study the lie of the strata and the containing walls for possible exits from the couloir. On big peaks the top of a couloir often opens upon an amphitheatre of slabs, too thinly ice coated for steps. It is then important to mark down a line for escape in time.

If the base of the couloir selected can be seen, the presence there of fallen stones is evidence that they have fallen ; but their absence there is not conclusive that they have not. They may have been swallowed by the bergschrund, disappeared into some crevasse, or lodged in soft concealing snow. For this end we must examine the edges of the schrund and of any cleavages for traces, and the surface of the lower snow for pockling. If there are channels worn in the snow or ice at the base or back of the couloir, we shall get further evidence that something is accustomed to fall. These channels may have been made by stones, by ice trash or by water. In sunshine the difference is distinguishable. If the runnels are ' silver-backed ' in sunlight, and there are no stones apparent, they have been made by water and are harmless.

If the couloir to be visited descends on to a visible glacier, but is itself invisible, the presence, absence or scarcity of fallen stones discoverable at the bottom end of the glacier, subject always to the possibility of the i

consumption by rift or crevasse, will demonstrate the couloir, or couloirs, commanding the visible glacier to be proportionately infected with, free from, or only in some cases liable to, the falling sickness.

Rock.

In prospecting rock routes we have more to help us; for rock, unlike snow, does not change its skin, and when it hides itself, under ice or snow or water or glaze, the change from the black Ethiopian is obvious and calculable. We have also preliminary information, if not in books yet in the outlines of the mountains themselves, as to what is the character of the particular rock before us. Every climber, if he can assume the presence of limestone or granite or dolomite, sandstone, trap, chalk, or a few other of the elementary and lay classifications, has a clear picture in his own mind of the kind of climbing and of rock holds that he may expect.

Faces.

The slopes of the hills will tell him in general; good glasses will tell him more of his particular route or of local modifications in the characteristics:—such as how the rock is weathering; in which direction the strata are dipping; and what is the fashion of the jointing. Putting this information and his knowledge of the type of rock together, he will know upon which side to attack his peak.

For instance, if the strata dip through the peak, the aspect of the mountain upon which the upper ends of the strata emerge will give him holds sloped upwards to his advantage. This side, with its *retroussé* ledges, will also hold fresh snow longest after a fall, and at such a time afford him a further chance of locating the lie of traverse and shelf. If the main cleavages, again, are vertical, he will select the most weathered face, where the jointing will give him platform and shelf. If they are in the main horizontal, he has to seek the side that presents the most sequent line of weathering rifts or fractures, in order to connect up the natural horizontal ledges.

Just as a sunny day is of most help in prospecting an unknown snow climb, so is the day after a snowfall invaluable for the examination of rock routes. I owe several fine new rock climbs to snowfalls. Not only does the lodging snow indicate particular ledges and their intervals in detail, but it discovers to the eye

general connecting lines of traverse or slope, which may be too interrupted or too foreshortened to be perceptible upon a distant inspection of the bare and broken rock face. Under snow the main lines of rock structure leap into sight.

By a convenient law of rock formation, the little apes the great. Thus, if we can discover the general inclination of traverses across a face, however large in scale, broken or interrupted their lines may be, it is safe to assume that the small details which make up these lines, the ledges, etc., will be reproducing the same fashion of structure in little. Where there are big terraces, there will be small ledges copying their form and direction. If there are big visible gaps, giant slabs, or terraces interrupted and continuing at a higher level as a result of uneven upheaval, in the same or similar places, although too small to be visible, the climber has to look out for exposed passages on slabs, or he will have to search for cracks to connect up his interrupted ledges.

It is all but impossible to inspect a distant climb with sufficient minuteness to be absolutely certain that a fifteen-foot wall or a broken ledge may not stop all progress at some point. Very rarely we can say, "It is impossible;" occasionally we can say, "It will go for certain;" but generally we have to leave some portion to the 'round the corner' chance. In such case we can reason with advantage from the big to the small, interpreting the main features of a face or ridge into terms of detail suitable for our lesser needs, and justifying it by our experience of similar rock.

Fortunately, rocks generally prove us right. They seldom cheat us, by a petty exception, of the fruits of general conclusions which we have based upon observation of their principal tendencies. On the contrary, we are constantly helped by kindly accidents and flaws, where we might expect no mercy. The Grépon traverse is a delightful instance of unreasonable progress just made possible by a series of, apparently, gorgeous accidents. The flukes are so brilliant and so timely that the layman cheerfully assumes them to be a rule in attacking similar Aiguilles; and he is rarely disappointed. When the expected and the unexpected alike fail us, on such rock we can still count upon a kindly roughness

of surface and upon homely methods of friction to join up connections which structure and luck would have, for once, denied to us.

In reconnoitring all rock faces, especially for new routes, we are alert about the matter of falling stones. On boldly sculptured faces the edges of the ribs will be the safest line. On faces of shallow relief or much interrupted modelling, we may assume that nothing but the angle or our fortune will secure us against cross-fire. We used to be told that we should avoid stones by selecting aspects where the up-lie of strata emerged in sky-ward and stone-catching ledges. But personally, I have been seldom so badly bombarded as upon the Zermatt face of the Matterhorn, where every schoolboy knows what happens to the strata. If the rock is known to be good rock, or if we can design a route which by reason of its angle or its salience on the face should be safe, we may chance a few exposed connecting links. But if the rock is notoriously bad, or the disconnections in the safe route look to be numerous, and this especially if they occur high up where the sun will have had long time to act before we reach them, we must not risk the attempt. Years ago our party turned back from completing the ascent of the Furggen ridge of the Matterhorn on the ground of risk from stone fall. Later it was climbed; and the story of the success might be read as a commentary on the mountaineering value of the virtue of renunciation.

The same reasoning from the big to the little helps us in prospecting ridge climbs. If the succeeding edges, towers and large interruptions on a great ridge show a disposition towards maintaining a steady family connection, each with its neighbour, in spite of their bold skyline accidentation—(I cannot put this more intelligibly; but any student of natural outline will know what is meant)—then there is every reason to hope that the 'cuts-off' between them will also prove more relenting than they look. In their smaller detail the same indulgences, of ledge and flake and fluke in favour of the climber, will manifest themselves.

Ridges.

A ridge seen end-on is very deceptive. If it rises steeply, it may appear to be a continuous incline, whereas it consists really of separated, ascending 'steps.' If a side view is not obtainable, the look of the walls falling

on either side from the ridge crest must be our guide. The depth, extent and number of depressions indicated in these side walls, seen in profile, will tell us that there are couloirs below, and therefore probably syncopations in the seemingly continuous crest-line above.

The projection of bulges or articulated ribs on either side wall may, similarly, be identified as the edges or supporting buttresses of isolated towers, whose depth of separation from each other is concealed from us in the foreshortening of the ridge.

Towers on a ridge, seen in flat from one side, are equally misleading. They are more often the ends of short ridges which run crosswise to the line of the main ridge than the needles which they appear to the eye. An inspection of the general lie of the strata will often tell us whether we may assume this to be the case.

If we can get both an end-on view and some oblique view of the ridge, or of any tower upon it, we can reason fairly closely what the two unseen sides of any spire will be like, and even whether they can be expected to offer traverses conveniently sloping, or weathered surfaces, such as the dip of the strata and the jointing deny to us upon the visible sides.

Allowance must always be made for the deceptive outlines that are introduced by foreshortening. A view from some second point is often necessary to counteract their false impression.

In prospecting a ridge for purpose of traverse in the early morning, it is well also to note which side gets the sun soonest and keeps it longest. On this side we shall find the holds most clear of snow or morning glazing, and be able to escape the chill to the muscles of shadow on cold rock. The rock on this side also will, for the same reason, be probably the more superficially disintegrated, and so offer a greater choice of holds, though not necessarily holds of such good quality.

Slabs.

In reconnoitring slabs, on faces or on the side walls of ridges, we find that their apparent angle as seen in face is as misleading as that of snow slopes. In their case we have not the presumptive knowledge that they cannot be as steep as they seem, since rock may be as perpendicular as it looks. Nor have we the subtle variations in light and shadow which help us, on snow, to correct the eye. Rock faces are so

broken that it is seldom possible to get the assistance of sun shadows in estimating the angle of portions of their surface.

On the other hand, acquaintance with the characteristics of the particular type of rock, and the visible general inclination of its strata, give us a groundwork for a preliminary estimate of its slabiferous sections.

New snow can again come to our assistance. Snow will reveal to us an easy angle by lying over our slabs as an even cloak ; or it may display a vertical section by missing it altogether. It will also indicate the surface in some detail, by the fashion of its distribution on ledge or pocket.

Otherwise we must try to secure a side view of bare slabs, or at least a second, oblique view. If this is not to be managed, it is of use to inspect any near and more approachable slab of similar formation. By an examination of the profile of a ' sample ' slab we are often able to revise our estimate of the angle and potential holds of its bigger, remoter neighbours.

But on rock the final judgment of doubtful passages must be left in the end to the practical test of attempt. The only infallible criterion is its tactile value. When we have reduced the ' impossible ' sections of a route to a few isolated passages, it is always worth while going to see. The accidents of rock, its roughness, its whimsicality and its reticences are nearly always in the end in our favour. If we can only make sure that the rock is sound, and fix a general line of ascent, the overcoming of the ' impossibles ' or the ' improbables ' in detail can well be left to the moment. If we could map out a whole climb before we did it, much of the pleasure would be lost.

To the resources of rock technique no rock that is sound, and not obviously absurd, is impossible, either by attack or turning movement. And we may assume this to be so until we have ascertained by ' rubbing our noses against it ' that we have lighted on the rare and unhappy exception.

Rocks in Britain.

In prospecting rock climbs in our own country, reconnoitring is practically confined to scrutinizing familiar faces for alternative routes or to orienting our own climbing in an unfamiliar district.

The first is a simple matter of good glasses, good

sense and direct assault. In the second, there is still some room for general discretion.

We have to allow for a great difference in atmosphere as between Britain and the Alps. All alpine measures have to be reduced by about two-thirds.

We can generally assume that the north or northward inclined aspects of British hills will give us the best climbing. This judgment is subject to partial revision, according as we come to know better the local characteristics or the rock formation of the particular hill before us.

If the rock wall faces to the south, our prospect of good continuous climbing is reduced. Rocks facing south will be more disintegrated, as they will have been less protected from the sun and more subject to strong variations in temperature. If broken up or inclined on this side, they will be covered with verdure, which is offensive in itself and hastens the action of water on all the rocks it commands.

We have also to make sure of the lie of the strata, not only for convenience of hold, but also because on the side towards which the stratification dips the moisture fallen on the mountain will drain, and we shall have to look out for our principal enemies—wet rock, rock corrupted by moisture, and, in winter, an icing or glaze.

Our islands provide us with a great variety of rock structure and hill forms, and, according as we get to know the aspects of one hill of any local type, it is interesting to reconstruct the unseen aspects of its neighbours. Several good climbing cliffs were first found in this way.

The look of the outline will suggest the sort of climbing we shall find on the faces. We get further information from the nature and size of any scree slopes below a cliff. The presence or absence of verdure, and the sight of the belts, knots and surface *minutiæ*, tell us the rest.

All the local rock of the same aspect and in the same structural line will be similar, and may be bad; but if we can get at another aspect of it, on an opposite hillside, it may be of good holding character. For which reason rickety ridgelets may be faced across the valley by sober and admirable slabs.

Mist and cloud in Britain are our frequent companions. Mist may do us good service by throwing an unsuspected ridge or pinnacle into relief. But as a rule

the alterations which cloud and fog effect in mountain details falsify rather than reveal. Their use is to place a greater value upon the fidelity with which previous reconnoitring has been conducted, and its result remembered, if we wish, in mist, to arrive at an intended climb at all, or to make descent into the right valley on our return. Not impossibly they are sent by nature to complicate what is otherwise the over-easy mountaineering training of our hills; to handicap the specializing gymnast, and to enforce the practices of observing detail, using the compass and map, and exercising judgment, memory, and the precious sense of direction.

The Half-seen

In the Alps or unfamiliar regions, to discover the truth about what may be termed the half-seen,—that is, about formation or detail which should be visible but for foreshortening, distance, angle or light,—new snow is again our best auxiliary. Its presence suggests, even emphasizes, much that is unsuspected. Seemingly straight ridges are shown to be crooked, and plain faces rough. It helps us with light in hidden corners, and annihilates distance.

Otherwise we have to use days of driving cloud, or wait for the morning or evening moments of thin mist, when the drift lies across the face or through the ridge, and picks out its angles, features and perspective. Mists will often reveal the existence of ridges and pinnacles, whose separation from the face behind is undiscoverable as seen in front or in clear light.

Of more frequent service are the hours when the sunlight falls across the face from the side, and the protuberances and hollows jump into stereoscopic clearness in shadow and the modifications of light. Invisible snow depressions, bosses and foreshortened angles of rock slab or ledge are cheerfully betrayed by the veracity of cross-shadows; and points and lines of obstinate sunlight, which remain salient and surprising after the sun has deserted all the rest of the seemingly even surface of snow or rock, proclaim to us unexpected inequalities and therefore possibilities of passage.

In cases of outside difficulty upon rock, where we are reconnoitring some great rock wall, of a granite or

dolomitic type, we can generally make sure of the vertical rifts and clefts from below; but the presence or size of transverse fractures or belts is hidden from us. In this case assurance as to what has been only half-seen can be completed if a downward view of the rock, or of its local type, is also obtainable. The information is best secured from the summit of the peak itself, reached by another route, and many great first ascents have owed their discovery and safe accomplishment to such complementary inspection. Only a short section need be in sight from above in order to indicate the general character of the cross belts, and the last section on such peaks is always the more important to examine, as it will generally be the severest in its details. But even without this local visitation a downward or oblique view of any section of the face, or of an allied or neighbouring wall of similar structure, will give adequate information, and convert the half-seen into the two-thirds made certain.

A familiar instance of the use of such inspection would be almost any great Welsh cliff or Irish sea cliff. Seen from below, it appears to be continuous steep slabs, with only vertical cracks for the climber; seen from above, it looks a jumble of vague cross-terraces of grass, snow or rock, hardly offering a chance of good articulated climbs. Both estimates would be false. Only by collating the two points of view can a fair judgment of the character of the climbing be formed. A number of delightful climbs, of late discovery, have owed their neglect to the fact that they were only easily visible from a single aspect, and that this produced an abiding false estimate of their quality. The importance of securing corrective views, from different angles, be it only of a section of a proposed route, or of a passage of similar character more conveniently situated, attaches also to our inspection of the half-seen on big ridges. With points to remember in such inspection I have already dealt.

It does, in fact, belong not a little to the reasoning from the seen to the unseen; to which more metaphysical division of reconnoitring it leads over.

The Unseen

The investigation of the unseen is a chief concern of mountaineers in new regions. But it can also be of

service to the expert, in examining even a peak he knows well, to ascertain for him the condition of its invisible side on a particular day.

As I have said before, it is possible only to indicate *where* signs may be sought, and what *relative* differences the expert eye may discover and convert into information.

The mountaineer, after inspection of the near side of a ridge or summit in a big range, wishes to supplement this knowledge by the discovery of the character or general formation of the unseen side. He wishes to know whether it will give him snow of easier progress, or a subordinate ridge for better assault or descent ; also whether he can look for clear rock on the far side, to assist his ascent of a ridge unfavourable in its visible aspects, or whether he must be prepared for ice slopes.

The first conditions for the inspection are experience, good glasses, clear sunlight and no recent snowfall. Also, if he wishes to confirm or increase the detail of his observations, he must be prepared to spend a whole day of good light, with the sun aiding him from different points in the sky.

As he looks over and across his high ridges from some distant view-point, in good sunlight, the mountaineer is able to distinguish several different kinds of sky, according to the different character of the unseen surfaces from which the sunlight is being reflected upward on to clear atmosphere or on to low clouds.

The Snow Sky.—This he will find has a distinguishable tint, identifiable by the practised eye, as different on a given day from the normal coloration of the sky above as is the light reflected from different qualities of steel, or from silver as compared with electroplate.

If the sky seen over his ridge is purely a snow sky, of uniform appearance, it is just to assume that the unseen side of the ridge consists of large snow slopes, and rises at a comparatively gentle angle, since we know already that upon broad surfaces, at a steep angle, snow can only rest while it remains new and adhesive.

If, again, the sky above is purely a snow sky, but is traversed by a band of slightly modified quality or tone, leading away from the eye, there will exist on the far side a correspondingly inclined great snow ridge, from one side of which the sun, in a given position, will be re-

flecting high light, but from the other, lower. By repeating the observation at different times of day, so that the light will have fallen and been reflected from different directions, we can confirm the existence of such a ridge, and may be able to locate its position and determine its magnitude with some accuracy.

A second and characteristic appearance is visible on the sky above the unseen side, if this far side consists of two large snow fields divided by a long rocky ridge extending away from us. We then have a snow sky divided by a band of sky which is not catching any reflected higher light, and which we may assume to be a 'rock' sky.

The Rock Sky.—If the whole expanse of the sky above is seen to have a uniform and normal tone with no local alterations, such as would be produced by partial snow reflection, then the unseen side will consist of a large wall of rock—probably, in such case, steep rock.

Under favourable conditions, a very practised observer may detect in a uniform rock sky a band of slightly modified tone going away from the eye on the far side. This will be produced by another great rock ridge extending in the corresponding direction. By watching the sky above this ridge, and observing the differences produced by the reflections of light at different hours from its different aspects, we may even be able to discover to our satisfaction whether the invisible ridge is all rock or has one side covered with snow.

The Ice Sky.—Dry glacier or large fields of ice betray themselves upon the sky in a slightly greyer tinge, distinguishable more by contrast than by an absolute tone from a snow sky under the same conditions.

There is also a 'water' sky—the unmistakable look in a sky which is reflecting great unseen sheets of water; but its identification is more familiar and of more service to arctic or desert travellers than to mountaineers.

Apart from these larger sky signs there are some more local indications that are of particular value to the climber. The appearance of the sky as seen across the ridge will in most cases give us evidence of a mixed character—that the unseen side is partly rock, partly snow. It is thus essential to know, if we propose to use the ridge we are prospecting for our ascent, whether the rock just over or on the ridge is bare or ice glazed, and

whether the snow discovered on the far side rises up to the edge of the ridge or leaves a crest of clear rock.

If there are bare rocks close up to the edge on the unseen side, these will be at certain hours heated by the sun, and a hot current of air will be ascending. The skyline above will have a wavering appearance, showing a band of darker tint between the ridge and the normal sky.

If there is snow close up on the far side, the air will not be disturbed, and the skyline will be steady and clean.

If the rocks beyond are free from snow but glazed with ice, the skyline will remain undisturbed, but it will have a brilliant glistening appearance in strong sunlight, like a strip of polished blue steel. This last indication, if the eye can learn its significance, may often be of service on climbs where the unseen mountain structure is already known, but when there is uncertainty as to the actual condition of the rocks on the day. Many fruitless ascents might have been saved if the ice glazing on such unseen sections of a ridge could have been detected in time.

Some of these appearances may even be recognized in photographs, if they have been taken under the right conditions and left untouched. By watching a given section of ridge, while the sun is moving across the sky, all a sunny day, and by using a map at first to discover what the different sky signs as they become visible actually mean, and also how much they reveal of the unseen topography as displayed in the map, it is possible for some men to train their sight to discriminate fairly closely between a number of even more complex signs, and to ascertain actual details as to the character and direction of unseen walls and crests, the location of unseen snow summits, and the length of far ridges.

The process, in practical application, is of course throughout assisted, corrected, and its lines of observation suggested by the nearer features which the expert reconnoitrer already has in sight. For an observer who knows the forms usual in the type of mountain before him, and who has the local features, on the side visible to him, to indicate still more closely what he may look out for, the interpretation of the meaning of sky signs presents fewer alternatives, and the conclusions drawn from them can be far more detailed than would seem

possible were his reasoning about the unseen based only upon one group of evidences.

Final success in reconnoitring depends upon our ability to put together, in order of their relative importance, all our assembly of large and small evidences. Experience is able to deduce the small from the large and to reconstruct the large from the small; and confirmation of the truth of our deductions, from the seen or the unseen, comes when two such lines of evidence meet: when the detail which we discover in a single quarter confirms the speculations that we have based upon our experience or on our interpretation of larger evidences, or when our induction from a number of small visible indications is proved correct by some revelation in a greater sky sign.

For a mountaineer who has to convert his observation of distant objects and signs, of a size altogether incommensurate with his own, into terms of a possible advance for his eight-foot reach or four-foot stride, no evidence is too big or too small;—and this especially because the big, in mountains, repeats itself in the small with timely consistency. A good mountaineer might almost claim to be able to construe a single favourable sky sign, under certain conditions, into the assurance of his atom-like advance up the infinite invisible detail of an unpromising-looking mountain giant.

Sunny days, patience and good glasses are first conditions for his task. The same glasses should always be used. A type should be selected that gives enhanced stereoscopic effect. Above all, the sight of the eyes must be equal, or corrective glasses should be worn. Many men never discover even what they ought to be able to see, until they learn that their eyesight is, if only slightly, astigmatic, and use spectacles for their reconnoitring.

Reconnoitring is not merely the preparation for a single day or for a particular climb. A mountaineer has to learn to see and to record all day and every day, not only distant signs for future use, but each and every detail of his surroundings. The detail may be forgotten, but its accumulation will gradually form in his mind a mass of general precedents and of knowledge of the characteristics of particular shapes and structures. This will remain with him, and will return instinctively to aid his judgment when some cognate detail presents itself to be

interpreted as a piece of solitary evidence. As a last personal illustration, I may recall that one of the pleasantest new ascents in my recollection was the outcome of a simple reasoning from a detail in the seen to the memory of the unseen: the sight of a layer of excellent snow, covering for the time the usually bare slabs of one wall of a peak from which we were descending, revived the recollection that on a famous peak in another valley was a similar wall of identical aspect and character, as yet unascended on account of its normal impracticability. Without further examination we made the attempt upon it, and the speculation was confirmed in the cheeriest manner.

If care so constant that it dominates alike the exhaustion of failure and the more dangerous enervation of triumph is essential for our safe climbing, observation so continuous that it becomes unconscious is as necessary for our fortunate designing. Its habit may profit us by more even than by momentary success. For a mountaineer may read a sky sign only for the promise that it brings him of the morrow's exercise; but he has learned to see it, and with the power of sight he has opened a new world of pleasure. It was the first scientific student of the form and reflection of clouds, of the structure and relation of hills, who was the first understanding prophet of their significance for art and imagination. The more we can learn to see or to reconstruct of the mountain forms visible or invisible about us as we climb, the more vividly will memory interpret their meaning for our lives when we are no longer among them. If we are of a mood to use both sight and its interpretation as servants of our spirit as much as of our performance, we may discover a reflection from the mountains that will permanently colour our thought. There is a reassurance no less for our journey through the years than for our march of a day in the perception that oncoming shadow, by its very quality of darker relief, can reveal to us some unsuspected and relenting aspect in the daunting precipice across our path; and a twofold message, for our mind even more than for our mountaineering, in "the light of the unseen snow-field, lying level behind the visible peaks, sent up with strange reflections upon the clouds; an everlasting light of calm aurora in the north."

CHAPTER IX

MOUNTAINEERING ON SKI

BY ARNOLD LUNN

WINTER mountaineering may be said to date from Mr. Moore's crossing of the Strahlegg and Finsteraarjoch Passes in January 1865. The first big peak to be climbed in winter was the Wetterhorn, which was ascended in 1874 by the Rev. W. A. B. Coolidge and Miss Brevort ; a few days later this party climbed the Jungfrau. These brilliant expeditions set a fashion which was, however, only followed by a select company of mountaineers, among whom a place of honour must be given to Mrs. Le Blonde. It was not until Paulcke crossed the Oberland at the end of 1897 on the ski that winter mountaineering began to be a popular sport. To wade up a big peak in deep snow on snow-shoes or on foot only appealed to a minority, but the number of those who were attracted by the chance of combining mountaineering with ski-ing steadily increased.

The English were slow to follow the new fashion ; the number of British ski-runners who have a long list of glacier ski tours to their credit is still small, but abroad hundreds of experienced mountaineers have explored the High Alps on ski, and abroad the advisability of using the ski in the High Alps has passed beyond the limits of discussion.

The time is coming when most alpine huts will be provided with ski. A steadily increasing number of mountaineers realize that such peaks as Monte Rosa or the Zermatt Breithorn provide excellent ski-ing at all months of the year, and that the trouble of dragging a light pair of summer ski to the summit is well repaid by a magnificent run down to the hut.

There is no month in the year in which the writer

has not enjoyed first-class ski-ing, and there is no season in the whole alpine calendar in which ski cannot be used on the loftier snow peaks in the Alps. Ski have come to stay as an indispensable adjunct to mountaineering. To the rock climber the ski are perhaps mainly useful in bad seasons ; if the weather in summer were uniformly good the enthusiastic rock climber would have little use for the ski. But long spells of bad weather are not unknown, and many a climber who has engaged a guide or a couple of guides for a month has spent a week, a fortnight, or in some cases even longer without climbing a peak. I venture to assert that if he took himself and his ski to a club hut he would at least have the satisfaction of making good use even of an afternoon's fine weather. I remember once finding myself at the Egon von Steiger hut during bad weather. It snowed all day and all night, and cleared at ten o'clock the next morning. Two parties on foot attempted the easy Ebnefluh. Both were driven back after a very brief struggle with deep soft snow. Myself and a friend reached the summit on ski in more or less normal time, and enjoyed a wonderful run back to the hut, where the disgruntled foot-sloggers had spent the day.

Let the rock climber learn to ski, and when the big rock peaks are deep in snow he will be able to snatch a Monte Rosa or Breithorn from the first fine day. In bad seasons individual fine days are often sandwiched between two or three days of bad weather. Such isolated days are useless to the foot-climber but invaluable to the ski-runner.

I cannot spare the space to explain the technique of ski-ing.[1] Here I need only attempt to dispel a lingering belief, that dies hard, to the effect that there is one technique for ordinary ski-runners and another for mountaineers. This curious superstition is the last relic of an exploded system of ski-ing taught by an Austrian called Zdarsky, the main effect of which was to encourage timid, slow and clumsy ski-ing. The 'Lillienfeld' ski were short, and made straight running very difficult and turning very easy. The Lillienfeld

Technique.

[1] I may perhaps refer the reader to my own book *Cross Country Ski-ing* (Methuen) or to V. Caulfeild's book *How to Ski* for the technique of ski-ing.

SNOW WAYS [JEAN GABERELL

system taught people to ski very quickly by dodging all difficulties and encouraged a free use of the stick. It was a bad system, and is now quite discredited; but there still lingers a curious belief that the Norwegian style may be all very well for small mountains but is too dashing and insecure for the High Alps. As a rule, glacier ski-ing is far easier than ski-ing among the lower mountains; the most difficult of all ski-ing country is wooded country, such as extends for miles round Christiania, the home of the 'Norwegian style.' Let me therefore urge the reader to master the free Norwegian style, to make all his turns and swings without the aid of the stick, and to acquire a free and dashing style. The mountaineer even more than the low-level ski-runner should have complete control of his ski, and complete control is impossible unless you have learned to control your ski not by means of the stick, but by means of the ski themselves.

There are a few occasions on which the use of the stick is permissible on tour; but it is so dangerous to begin by using the stick as a brake, that I would advise the beginner NEVER to use the stick until he has at least passed the 'THIRD-CLASS TEST' which is held from time to time in all ski-ing centres patronized by British runners.

Furthermore, though of course it is absurd to take risks in the High Alps, occasions often arise where speed means safety. With bad weather or night approaching, the man who can run fast stands more chance than the man who can not, and, consequently, the higher your speed consistent with safety the better your chances. Now, a high speed consistent with safety can only be maintained by those who have lost no chance on small expeditions of raising the speed at which they feel comfortable, and this, again, can only be achieved by running just a little faster than is quite comfortable.

In the High Alps a reckless runner, who is always falling, is a danger to his companions and himself, but a man who is quite incapable of a fair speed is always a nuisance on tour, and may sometimes prove a danger. Steadiness is the first requisite in the High Alps, but speed is by no means unimportant. Any man with average balance and nerve, if he is properly taught,

can learn to run steadily and to make slow turns on average snow at the end of a fortnight. To become a really expert ski-runner is, of course, another matter, but some of the finest ski-turns in the High Alps have been carried through with success by men who were not even third-class runners. Let the mountaineer learn to ski and take such chances as a snowy summer may afford. In a few hours he will begin to enjoy ski-ing, and his enjoyment will steadily increase with his experience. It is easy to become a third-class ski-runner, and very well worth while taking sufficient trouble to become a second-class runner. First-class ski-ing is, of course, not within the reach of all.

In order to make much that follows comprehensible to the reader, who, though a mountaineer, has yet to become a ski-runner, a short definition of the ski-ing turns and swings is necessary.

The object of every ski-runner is to approximate as nearly as possible in his course to a straight line between the point of departure and the goal. Obviously this ideal is impossible of attainment save on comparatively short open slopes, which can be taken straight. Hence the regrettable necessity of turns and swings which, unlike skating turns and swings, are not an end in themselves, and are only incidentally beautiful and graceful to execute and to watch.

There are three principal turns or swings: the *Stemming turn*, the *Telemark*, the *Christiania*.

Each of these turns can be used either as a stop turn (i.e. in order to stop more or less suddenly), or as a means of linking one tack to another. For instance, a slope may be too steep to take straight; in this case the good runner descends in a series of linked curves.

According to the condition of the snow, he will make these linked curves either by means of the Stemming, the Telemark, or the Christiania turns.

The Stemming turn is the easiest and slowest turn. It is the key to alpine ski-ing, and can be employed on snow on which a Telemark or linked Christiania would be either difficult or impossible. The beginner should try to combine Stemming with Christianias, to begin his turn as a Stem and to finish with a Christiania. This swing, which is sometimes called a Stem-Christiania or a 'Closed Christiania' (as opposed to 'Open Christianias'),

or by a natural abbreviation a 'Closti,' is the most generally useful of ski-ing swings.

The Lillienfeld system placed exclusive reliance on the Stemming turn and dismissed the other two as fancy tricks. This was absurd, for in many kinds of snow the Telemark or Christiania is much the more useful manœuvre. Either of these latter turns can be executed at a very high speed, whereas the Stemming turn cannot be done at a high speed.

The Telemark is mainly useful in deep soft snow or in soft breakable crust; in either of which the Stemming turn and the linked Christiania is difficult or impossible.

The Christiania, as a stop turn, is the safest method of stopping at high speed. Linked open Christianias are not easy to master, but are very satisfactory when mastered. Wherever a linked series of Christianias can be executed, linked Stem-Christianias are easier, and safer. The power to make a series of continuous non-stop turns with the Christiania marks out the expert; nothing is more beautiful than fast descent on glacier snow, film crust or crust slightly softened by means of a series of swift-running Christianias.

For the High Alps I consider that the Stemming turn and the Christiania should always be used in preference to the Telemark, excepting in very deep soft snow—rare in the High Alps—or in soft breakable crust.

The Telemark is a one-foot turn; all the weight is on the leading foot; consequently the Telemark is less powerful and less sure than the Christiania, which is a two-foot turn. Furthermore, the falls resulting from a Telemark which has gone wrong are more dangerous than from any other turn. From a faulty Christiania or Stemming turn one is usually thrown backwards or sideways against the slope; from a faulty Telemark one is often thrown on to one's head or outwards from the slope. Further, the ski have a nasty habit of crossing behind in a badly timed Telemark.

To sum up: Use the stick as little as possible. Make all your linked turns by Stem-Christianias, except in deep soft snow or breakable crust, where the Telemark should be used. For a sudden stop use the Christiania in preference to the Telemark.

In addition to the ordinary mountaineer's equipment, the ski-runner must have ski, sealskins, ski-sticks and repair outfit for ski.

Equipment.

I have no space to advise on the choice of ski, but I might warn the reader against the common illusion that ski for mountaineering should be markedly shorter than ski for short tours. They should be a couple of inches shorter, but very short ski should not be used save in the summer. I have used the longest size obtainable (2·36 in.) for quite long tours, and the next longest size (2·31 in.) in the High Alps.

Sealskin are detachable, and are fixed on to the ski to prevent the ski side-slipping while climbing a steep slope. Ski-ing boots are bigger than mountaineering boots. They should be nailed—lightly nailed, of course, but on no account entirely nailless. The nailless ski-ing boot is a superstition imported from Norway, where the hills are milder in gradient than in the Alps.

For all glacier tours crampons, or, to use another word, 'ice-claws,' should be taken. Eight-pointers are best, though good work can be done with six-pointers. The small four pointers are most insecure and uncomfortable.

For all further details as to equipment the reader may consult my book *Cross Country Ski-ing*.

The Alpine Calendar

The first winter snows usually fall in October: excellent ski-ing is often obtained at the ordinary winter sports centres in October. Glacier tours should certainly not be attempted before December, as the danger from crevasses is at its maximum in October and November. January and February are the best months for ski tours up to about ten thousand feet. The winter proper is NOT the best season for glacier ski tours, though most of the classic ski tours in the High Alps have been carried out between December and the end of February. Good ski-ing can be obtained at low levels well on to the end of April, and sometimes even later. As a rule, the snow lies down to about five thousand feet on north slopes well on into the middle of May.

MAY AND JUNE ARE THE BEST MONTHS FOR GLACIER

SKI-ING, though excellent ski-ing may be obtained throughout the summer. There is no month in the year in which the High Alps do not yield good snow, but the best all-round months for mountaineering on ski are undoubtedly May and June.

Snow Craft

The expert cross-country ski-runner must not only be a fast and safe runner on all kinds of snow and ground, but he must also possess a thorough knowledge of snow craft. Unfortunately, there are nine ski-runners whose Telemarks are perfect for one whose knowledge of snow is even adequate, and the number of those whose understanding of snow in all seasons of the year is really expert is indeed small.

Snow craft in winter and in spring is even more complex than in summer, and requires a special study of its own. Even the most expert guides whose knowledge of summer snow leaves nothing to be desired require considerable winter experience before they are thoroughly competent to lead a party among the High Alps in winter. The same is true of spring; each season, in fact, requires a separate study.

The ski-runner needs to possess a more exact knowledge of snow than that which the foot-mountaineer requires. A mountaineer on foot is mainly interesting to discover whether the snow is hard enough to walk uphill without sinking in, and whether the snow is likely to avalanche. Hard snow, soft snow and avalanche snow are the three main categories in which the foot-mountaineer divides snow. He need not bother with all the delicate gradations of value that distinguish snow which is so hard that it will not take a Stemming turn, and snow which, though hard enough to bear a foot, will yet take a Christiania or even a Telemark.

The ski-runner who neglects snow craft is severely punished for his carelessness. He runs into fast and sticky snow and pitches heavily on his face, or from soft snow on to hard snow and falls heavily backwards. Even the least observant ski-runner soon realizes that an elementary knowledge of snow is essential to his comfort and his safety. His knowledge of snow

needs to be instinctive. On foot a man has time to probe and to examine, but on ski he has to diagnose the snow while travelling at a high speed. He has to possess an accurate sense of direction so that he can foretell the changes of snow that occur when travelling from, say, a north-east slope on to an eastern slope, or an eastern slope on to a south-eastern slope.

Quite as many bad ski-ing falls are caused by deficient snow craft as by deficient balance.

Precisely because even the most casual ski-runner is bound to learn from the past experience of nasty falls, ski-ing inevitably teaches even the most unobservant some knowledge of snow craft. A ski-runner cannot hand over the whole strategy of the day's campaign to a guide. He must think for himself and study for himself. In summer the real business of climbing usually begins when the glacier or the summer snowline is reached, but in winter a ski-runner can kill himself in an avalanche within an hour of the hotel. Snow craft begins in winter at the hotel door.

The careful study of snow is a fascinating branch of nature study. More can be learned from books than the reader might imagine. Once a ski-runner has grasped how snow is affected by altitude, orientation, wind and sun, he is in a better position to profit by his knowledge in practice than if he was forced painfully to unravel the laws of snow by personal observation. In the early days of ski-ing in the Alps the guides themselves were completely ignorant of the main laws of snow in winter. They are still, for the most part, ignorant of the subtleties of spring ski-ing, which is much more difficult to understand than winter ski-ing. In winter, if a snow slope holds good snow in the morning it will probably hold good snow throughout the day, but in spring the same slope goes through a regular cycle of changes. It may be unskiable at dawn, yield perfect ski-ing at midday, prove absolutely unsafe at three in the afternoon, and yield good running again in the evening.

To time a descent accurately, to forecast from a knowledge of the orientation and altitude of a given mountain that it will yield perfect ski-ing at a given hour, is to know one of the most satisfactory intellectual pleasures that the mountains afford.

Winter Snow

There are certain forms of snow which are characteristic of certain seasons. '*Powder snow*,' for instance, is normal in winter and uncommon in the late spring; none the less powder snow is often found even in summer, just as certain forms of snow which are characteristic of spring or early summer are occasionally found even in midwinter. 'Winter snow' must then be taken to mean the kind of snow which is common and characteristic of, but not limited to, winter.

Powder Snow.

In winter a normal snowfall is accompanied by a temperature below freezing; snow that falls with the temperature just above freezing usually descends in the form of sleet. Fortunately, such conditions are not common.

Snow will even fall when the temperature registers a degree or two of thaw. I have known dry snow fall with a temperature of two degrees above zero—centigrade, at a height of 5500 feet above the sea. Similarly, as icemakers know, water will freeze on a rink even when the temperature is above freezing-point.

The explanation for this anomaly may be sought in the well-known law that pressure lowers the freezing-point.[1] It seems a natural deduction that diminished pressure will *raise* the freezing-point. 0° centigrade is the freezing-point of water at sea-level. Under a pressure greater than that of the air at sea-level, the freezing-point is lowered so that the bottom of a glacier will be in a condition of liquefaction at a temperature below freezing. It should follow that an air pressure *less* than that of the air at sea-level should raise the freezing-point; or, in other words, that at any point above sea-level the freezing-point should be higher than zero. From my own observations I believe that water will freeze and rain turn to snow when the temperature is 2 degrees centigrade above zero at a height of 5000 feet.

Fortunately, the normal snowfall is accompanied by a temperature below freezing, for if the snow is on the point of turning to rain, it forms a crust when the temperature falls. A normal dry snowfall takes the form of small hexagonal crystals. Newly fallen snow

[1] I am ignorant of physics and should be glad to have this guess corroborated by a physicist.

is not compact, and contains a great deal of air, which slowly escapes as the snow settles, so that after a day or two the new snow has lost nearly a half of its apparent depth.

New snow is very soft and slow, but gives good running on steep slopes; though, of course, long steep slopes are liable to avalanche. Good running is also often obtained during a snowfall by choosing south slopes, previously covered by a hard crust; for there is nothing pleasanter than two or three inches of snow on hard crust, and during a gentle snowfall it is possible to enjoy quite good sport on such slopes. In general, expeditions—even quite short ones—are impossible till the snow stops, and unsafe for a day or two after a heavy fall. Newly fallen snow sticks badly in the sun even if the temperature is well below freezing.

Once, however, that the snow has settled it soon gives perfect running. One night's really hard frost is sufficient to produce excellent snow. *Powder snow* remains good almost indefinitely in winter on northern slopes, provided it is not spoiled by wind. It steadily improves. In sheltered places the crystals gradually grow in size so that sometimes you find large leaf-like formations, which rustle under the ski like autumn leaves. Such snow is a dream of paradise.

Powder snow is the ideal running surface. It is equally good for straight running and for swings. In deep soft powder the Telemark is the best swing, but in fairly compact powder any turn or swing is easy and safe.

The ski-runner who visits the Alps in winter, and has good luck, may run for day after day on perfect powder. He is in danger of thinking himself a better runner than he is. If he concentrates on Telemarks, the first tour in the High Alps, where he will meet varieties of hard and soft crust, will find him out badly. He should therefore make a point of spending a day or two on south slopes so as to master the Stemming turn on hard snow. If he is getting pleased with his Telemarks, let him try a Telemark on the soft breakable crust to be found on south slopes at midday, and if he can do a series of fast-linked Telemarks in such crust, he may then return to his powder snow with a good conscience.

The Effect of Wind on Powder Snow.

Snow which is spoiled by the sun is never quite impossible, and is always curable by a hair of the dog that bit it; in other words, by another and stronger dose of sun. But snow which has been wrecked by the wind is the despair of the ski-runner.

The wind does not affect snow that has once been crusted, so that wind-swept snow is almost unknown in spring. The favourite victim of wind is precisely that light, dry powdery snow which is so common in winter.

The effect of wind depends on three factors, the strength of the wind, the time during which the snow is exposed to the wind, and lastly the type of snow exposed to the wind. Powder snow is the most sensitive, the quickest to spoil and the most trying when spoiled. Hard crust is entirely unaffected; heavy wet snow is very little affected.

A light wind produces on powder snow the markings which are known as *ripplemark*, a term which has been applied by scientists to the rippled effects which can be traced, not only in snow, but also in sand, and even in clouds which have been influenced by wind. Sand and snow behave very similarly under the influence of wind. A slightly stronger wind, or a wind blowing for a longer spell, produces caked powder, which is dense and compact, but has not quite lost its powdery quality. The ski sink in to a depth of an inch or more, and though fast running is dangerous and apt to produce broken ski points, a good runner can derive much pleasure from caked powder, and can force linked Telemarks without much trouble. The third stage in the deterioration of snow occurs when the wind produces a hard crust. *Windboard* is hard and slippery, but so long as it is not varied with soft patches of sticky snow or of breakable crust, windboard yields a surface which may annoy the novice but which should not prove, at any rate on slopes of moderate gradient, too troublesome to an expert who has mastered his hard snow turns. Windboard is common during the winter months in the High Alps; in appearance and texture it is not unlike the hard marble crust, which is found on south slopes after a long spell of fine weather, but it is vital to discriminate between windboard and marble crust, because the former may sometimes break away

in slab avalanches whereas the latter never avalanches. Windboard betrays its origin by ripple markings, sometimes faint but seldom invisible to the practised eye. Windboard is often varied by pockets of sticky snow.

If wind produced nothing worse than caked powder or windboard, the ski-runner would have less cause for complaint. Unfortunately the wind often produces horrible surfaces which resemble each other only in their general unsuitability for ski-ing. *Skavla* is the generic Norwegian name for wind-swept snow, and skavla is common on the exposed fjords of Norway and Sweden, where it attains a degree of unpleasantness seldom matched in the Alps. Skavla varies. Sometimes skavla consists of patches of glittering ice varied by treacherous pockets of sticky snow; sometimes a breakable trap crust interspersed with windboard; sometimes waves of hard, icy snow which occasionally attain a height of two feet or more. The prevailing wind determines the direction of the waves and acts in precisely a contrary fashion to that of wind on water; for wind on snow has a burrowing effect, and forms these waves by excavating and eroding a slope, gradually forming a series of steps. In other words, whereas on the sea the wind will be found to be blowing up the longer slope of a wave, on snow the wind will have been blowing against the short steep side of the snowy waves.

To sum up: The effect of wind on powder snow is always bad. The stronger the wind and the longer that it blows, the worse the snow. Hence in winter avoid exposed slopes and seek out sheltered valleys. The summit slopes of winter mountains will usually be spoiled by the wind, which is one of many reasons why spring is so superior to winter as far as ski-ing in the High Alps is concerned.

The Effect of Sun on Powder Snow.

Powder snow acquires a crust if it is exposed to wind, to sun shining at a sufficiently direct angle, and to an air temperature above freezing. Wind alone has the power of forming crust without a preliminary melting of the surface. I do not know why this should be so, but no doubt the reason is to be found in the law that pressure lowers the freezing-point, so that the increased pressure caused by wind lowers the freezing-point, or, in other words, produces the effects of a thaw at the point where the

wind acts even though the general air temperature may be well below zero centigrade.

At any rate, sun, wind and thaw are alike in producing a surface crust.

The effect of the sun depends mainly upon the angle of inclination. In midwinter, snow will remain unaffected by the sun on northerly slopes even though they receive several hours of sunshine in the course of the day.

In fact, in midwinter eastern and western slopes retain powder snow for a very considerable time, while a slope that is a few degrees north of west or a few degrees north of east retains powder snow throughout the winter, always providing that it is not exposed to wind or to thaw.[1]

I use the term *'thaw' to denote a general air temperature above freezing as opposed to the purely local melting caused by the sun's rays*, which may be, and in fact normally is, accompanied by an air temperature in the shade of several degrees below freezing.

The thermometer will often be registering more than ten degrees of frost in the shade and twenty or more degrees of warmth—centigrade—in the sun. It is, as ice-makers know, quite common to find a belt of cold air, two feet in height, just above the snow and just below a strata of warm air several degrees above freezing-point.

In normal winter weather you may be uncomfortably warm in the sunshine, and yet the sun has no power to affect powder snow on any slope which has not a touch of south in it.

The steepest south slopes are the first to lose their powder snow. Afterwards, the gentler south slopes follow suit. Towards the end of February western and eastern slopes begin to crust. In March due north slopes still hold powder,—at any rate above 5000 or 6000 feet,—but slopes which are only a few degrees north of east or of west begin to crust. Finally, the level outruns get crusted, then the gentle due north slopes, and last of all steep north slopes.

Of course at high altitudes winter conditions prevail until well on into April.

[1] Eastern slopes retain powder snow rather longer than western slopes, possibly because the morning sun is less powerful than the evening sun, as the atmosphere warms up as the day proceeds. Further, as the prevailing alpine winds blow from the west, slopes that face east are less often spoiled by wind than those which face west.

In midwinter good ski-ing is usually to be had on south slopes for three or four days after a snowfall, though steep due south slopes soon crust. The time during which gentle south slopes or slopes which are just south of west or east will hold powder depends on the general air temperature and on the altitude. I have known pretty steep due south slopes hold powder below 4000 feet for three days of cloudless weather, but the temperature was about 15 degrees centigrade below freezing.

This is, however, unusual, and south slopes soon crust up even in midwinter. The sun melts the snow by day, and the melted snow refreezes at night, producing a crust. Such a crust will, at first, be soft and breakable.

Soft breakable crust is not a bad running surface. It is quite true, i.e. does not vary in pace from one place to another, and is usually soft enough to enable the ski-runner to make Telemark swings, either stop or linked, without much difficulty. Sometimes the crust is harder, and in this case the jump-round or *quersprung* is the only possible manœuvre.

A peculiarly villainous form of crust, fortunately rather rare, is known by the appropriate name of *Trap crust.* This crust is perfectly solid at one spot, and bears the weight of the ski without breaking, only to crack a few yards lower down. The ski-runner skids with great speed over the hard crust, only to be pulled up suddenly as his ski break through the soft crust below.

Trap crust is more usual in spring than in winter, especially on slopes which change in direction, so that the ski-runner passes from snow which has been sufficiently thawed to form a hard solid crust at night to slopes which have only been superficially melted. Trap crust is only found after fairly heavy falls of snow which require considerable time to form a solid crust. As a rule, trap crust covers a foot or more of powder snow.

To return, however, to more normal winter conditions. *Under normal conditions the snow on south slopes in winter is gradually transformed into crust.*

This crust is at first soft and breakable, but the continuous process of melting and refreezing gradually produces a solid unbreakable crust.

Unbreakable crust, as the ski-runner soon discovers, varies greatly in quality from hard crust which is so

hard that the ski slip sideways without obtaining the least grip, crust which on any slope but the most gentle is almost unskiable, to the other extreme, crust which though quite hard and unbreakable is rough enough to permit even a Telemark and to make Christianias and Stemming turns delightfully easy.

The solid crust formed in winter is usually very hard and slippery before the sun strikes it. This crust is known as *Marble Crust.* You find marble crust on southern slopes in winter, and at high altitudes in spring. It is common in the High Alps. Even at the very end of April I have known a slope at a height of 12,000 feet remain hard, slippery and unsoftened for some little time after the sun had struck it because a bitter north wind had lowered the temperature several degrees below freezing.

In mid-winter a slope of marble crust will yield good ski-ing after the sun has struck it, unless the air temperature is several degrees below freezing. Marble crust, touched by the sun, yields a surface which will puzzle the beginner but which is pure delight to the man who has mastered Stemming turns and Christianias. The excellent running that may be obtained on south slopes is too little exploited, for winter ski-runners are firmly convinced that good ski-ing can only be found on north slopes where powder lies.

Mid-winter may be said to last till the end of January. In February you often find perfect spring snow, Telemark crust, etc., on south slopes, and in February, as often as not, the best running is obtained on southern slopes. This type of running will be dealt with later.

Summary of Winter Snow.

Winter snow may therefore be summarized as follows. The normal winter snow which is found throughout the winter on northern slopes and occasionally on southern slopes is powder snow which is perhaps the ideal ski-ing snow.

Powder snow deteriorates under the influence of wind and sun. Wind is the more mischievous. A little wind does no great harm, and the expert can even ski with pleasure on the hard crust formed by wind, but the extreme action of wind often produces varieties of snow which are all but unskiable.

The High Alps and lofty summits in general being most exposed to wind will usually yield inferior ski-ing

to sheltered slopes. The best ski-ing in winter will therefore seldom be found on the glaciers.

Snow also deteriorates under the influence of sun, which forms a crust. This crust, however, once formed is often improved by a further dose of sun.

Though the best ski-ing is usually obtained on north slopes, excellent ski-ing is often obtained on south slopes by those whose knowledge of snow craft is sufficient to time their descent and to choose their route accurately.

Abnormal conditions produced by Föhn and thaw are dealt with on pp. 417–422.

Spring Snow

We have seen that good ski-ing in winter depends largely on the absence of wind. A sudden thaw may also produce a disastrous result, for snow which has once been rained on and refrozen will remain covered with crust until there is a new snowfall.

The best winter snow is without rival, but spring snow is, on the whole, safer and less capricious. In normal spring weather all snow is crusted in the early morning, for the sun is powerful enough to melt snow even on northern slopes. But this spring crust, as we shall soon show, is much less troublesome than crust in winter and yields very fine ski-ing indeed. Wind, the great enemy in winter, has no effect in spring, for wind cannot affect hard crust, and if wind blows while the snow is falling a few days of strong sun will melt any wind-formed crust and produce exactly the same surface as if the snow had never been touched by wind. It should, however, be added that, in the early spring, wind, though powerless on snow which has once been melted and crusted, is a great nuisance if it blows on snow which is still powdery, as is usually the case for twenty-four hours or so after a snowfall; snow which has once been crusted by the wind has a very strong resisting power to the action of the sun; I have known south snow in March retain irritating effects of wind action after several days of strong sun that would have been sufficiently potent to melt any ordinary crust.

Spring ski-ing is, as a rule, delightful. Snow is troublesome in the intermediate stage between powder and crust. Once a crust is formed, the more often that

crust is remelted and refrozen the better, as there is nothing better than old crystalline snow which has been through the mill of melting and refreezing again and again. Unless wet Föhn blows such snow will always retain its crystalline character, even when remelted by the sun, and will always yield good ski-ing. Of course in the late spring at low altitudes the sun is powerful enough thoroughly to thaw and drench the snow, and in the middle of May below 7000 feet wet snow in the middle of the day is unpleasant. But in March and April ski-ing on melted crust is wholly delightful. Incidentally the best ' Spring snow ' is often found at the end of or in the middle of February on southern slopes.

From the beginning of March onwards all slopes, save those at very high altitudes, begin to crust over. The process is gradual on northern slopes. There is a period when the northern slopes no longer hold the dry loose powder of winter but have not yet begun to crust.

Spring powder is common on north slopes in March. It is denser than winter powder, and is not so dry. It is slightly moist on the surface, and much heavier. It yields, however, a first-class running surface, and will take any turn or swing. Its main objection is the fact that it is peculiarly liable to avalanche.

Gradually, however, spring powder disappears, save at great heights, and all slopes are covered by crust. In the afternoon the crust is melted, and the snow is soft and wet on all slopes. At night the snow is refrozen.

The normal cycle, then, of a normal spring (say April, at altitudes between 3000 and 9000 feet) is as follows: Hard crust at dawn; crust superficially softened between sunrise and midday; soft melted snow in the afternoon; soft breakable crust as the sun loses in strength; and solid hard crust after the sunset.

First let us consider the hard crust usually found at dawn.

This differs materially from the marble crust of winter, and from any of the crusts formed by wind action. It is, as a rule, slightly softer. What is more to the point, it is rougher. The surface of normal spring crust is perforated by numberless little holes. Sometimes these holes are quite small, mere pock-marks, sometimes they are as large as half-crown pieces. It is the presence of these holes and the rough-

ness of the crust that makes steering easy, so that control is not difficult, and linked Christianias or Stemming turns are within the power of the good runner.

Perforated crust, in fact, is a delightful running surface. It is common at low altitudes in March, at moderate altitudes in April, and is normal in the High Alps in May, June, July and even August.

Film crust is found in May and June on the glaciers, and occasionally at low altitudes in April. It forms a delightful running surface. Unlike marble and perforated crust, it is not quite homogeneous. It is composed of a hard under-surface of solid crust, covered by a very thin, soft, and transparent film of ice, which glistens in the sun like burnished silver.

This film of soft ice is shorn away as the ski begin to come round on a turn. It provides a splendid purchase, preventing effectually all side-slip, and yet not sufficiently strong to make turns difficult.

Film crust is admirable for fast straight running, because at any moment the pace can be regulated by a swift turn. There is nothing finer than a run down the glaciers in the early morning on film crust.

We have seen that the cold nights of winter produce marble crust, which is hard and slippery. Marble crust is the kind of surface which needs crampons or a chip with the axe if it is climbed on foot.

Further, marble crust, and all forms of crust produced by winter winds, yield a very unsatisfactory surface, too slippery to give good purchase.

We have seen that the milder nights of April produce perforated crust which is much rougher and gives good ski-ing, while the even warmer nights of May and June produce film crust in which Christianias and Stemming turns are easy and safe. In fact film crust gives such a wonderful grip that even Telemarks are possible.

From this we deduce the following law:

Provided the night's frost is sufficient to produce a solid unbreakable crust, the crust will give the best ski-ing when the frost has been least severe.

In other words, "THE MILDER THE FROST THE BETTER THE CRUST."

This rule is important. It often happens in spring that one has to start down before the sun has produced a surface melting. Again and again the first thousand

feet or so of descent have been spoiled because the crust was too hard and slippery. But the lower one ran down the better the ski-ing. The hard marble crust of winter gave way to the perforated or film crust of spring. In April, in the High Alps, winter conditions often prevail at high altitudes to give way to spring conditions lower down. You start a run on marble crust and end on perforated or film crust. The lower the altitude the milder the night frost, and hence the better the crust.

But of course the hard crust of dawn is soon changed under the influence of the sun. At first the sun produces a slight surface softening which is, however, quite sufficient to make a great deal of difference. Even marble crust, if superficially softened, yields excellent running. Gradually the melting process becomes more pronounced. Sun-touched crust with a slight surface moistening—quite sufficient to make Christianias and Stemming turns a joy—yields to crust covered by an inch or two of melted snow. Such crust is known as *Telemark crust*—not because Christianias are not easy, but because Telemarks are very simple, whereas Telemarks are difficult, if not impossible, on hard crust.

Telemark crust is a normal stage in the passage of hard crust to melted snow. It is the practical certainty of finding Telemark crust at certain hours in spring that makes spring ski-ing in fine weather such a delight.[1]

As the sun increases in strength all trace of the underlying crust disappears. The snow is melted through and through, and becomes dangerous on steep slopes.

This wet snow is often slow, but it never sticks like the wet snow of winter. On steep slopes it gives good running—if unsafe.

Snow sticks in the intermediate stage between freezing and thawing. Thus powder snow which is beginning to thaw sticks abominably, but snow which is melted through and through does not stick. Snow which has once been thoroughly melted and then refrozen will never stick badly again. A surface of wet snow overlying powder will, of course, stick, but melting snow which rests either on hard crust or on the hard ground

[1] Sometimes when the night is unusually mild the crust is not sufficiently firm, and at the first touch of sun, it does not merely melt superficially producing Telemark crust, but gives under the ski and yields very nasty running. This is usually the case at *low* altitudes in May.

does not stick. It may be slow, but it does not adhere in sticky lumps to the running surface.

Thus two inches of melted snow on top of crust (Telemark crust) gives a fine running surface, and an inch or even less of wet snow on grass also gives excellent sport.

Snow that has been melted and refrozen night after night soon acquires a crystalline character. When the crust begins to melt after the sun has struck it, the melting surface is composed of numerous wet crystals, sometimes about the size of salt crystals, sometimes much larger.

This *granular* snow is familiar to all spring runners, and gives an excellent ski-ing surface. Occasionally towards sunset, as the wet heavy snow that is usually found in the afternoon during the wet spring begins to freeze again, you will find the snow assuming a very marked crystalline formation, which resembles the wet hypo crystals with which photographers are familiar.

In general, so long as snow retains a crystalline formation it gives good running. Salt snow or hypo snow yields excellent sport. In May at *low* altitudes the sun, however, is so powerful that it dissolves the crystals and reduces all the snow to one consistent heavy wet slush. Such snow does not stick—that is to say, it does not adhere to the running surface—but it is very slow. Furthermore it is dangerous, because if you run suddenly on to a patch of this very heavy snow you are liable to be pitched on to your face. Often the snow is not only melted downwards but upwards, for the ground is very warm in spring, and thaws the snow from below, so that you will often find a patch of soft heavy snow resting in the form of a shallow bridge on an empty space. The ski break down the bridge of snow, and the ski-runner pitches heavily forward. Such hollow snow is seldom found in April, but is common in May at lowish altitudes. In May the best ski-ing at low altitudes (5000–7000 feet) is obtained before 10 a.m. and after 7 p.m. In the early morning and just after sunset I have often enjoyed first-class ski-ing right down to 5000 feet and lower, well on into the middle of May.

We may therefore sum up the normal cycle of a spring day as follows:

At dawn every slope will be covered by a hard homogeneous crust. This crust will be either marble crust, in which case it will yield very difficult and unpleasant

ski-ing, or perforated crust or film crust. Perforated and film crusts give excellent ski-ing even *before* the sun has begun to soften the crust.

When the sun begins to gain in strength the hard crust is superficially softened, and gives good running even in the case of marble crust.

A later stage is reached when the hard crust is softened to a depth of about two or three inches (Telemark crust). This again gives good running.

Either before or after midday, according to altitude and inclination, all traces of crust disappear, and all slopes at moderate altitudes are reduced to wet, heavy and more or less water-logged snow. In the early spring this stage is perhaps only reached on southern slopes. In the late spring it is reached on all slopes at low altitudes and on north slopes, save, perhaps, at very high altitudes. In general, the ski-runner should not be abroad at such hours. Towards evening the slopes begin to refreeze. There may be an interval of hypo snow—soft hypo-like crystals in which fast running and every kind of swing is perfectly safe and easy. This is soon followed by the formation of a soft breakable crust, which gradually hardens until at last the cycle is complete by the formation of a hard solid crust.

THUS IN GENERAL THERE ARE TWO PERIODS OF A SPRING DAY WHEN SKI-ING IS EASY, FAST AND SAFE. THE FIRST PERIOD IS WHEN THE HARD CRUST BEGINS TO SOFTEN, AND THE SECOND PERIOD IS WHEN THE WET MELTED SNOW BEGINS TO FREEZE. THE SKI-ING IS LEAST PLEASANT AND MOST DANGEROUS BETWEEN MIDDAY AND SUNSET.

THE EFFECT OF FÖHN AND THAW

So far we have discussed normal winter and spring conditions. Föhn is, unfortunately, associated not only with spring but with winter. The conditions that are produced by Föhn are, however, spring conditions rather than winter conditions; for Föhn, though by no means uncommon in winter, is at least abnormal, whereas periods, more or less prolonged, of Föhn weather may be regarded as normal in spring. The peasants have a saying that, if the Föhn did not blow, the good God and the warm sun could do little with the snow. Certainly but for Föhn Switzerland would still be covered with glaciers.

Föhn, strictly speaking, should be used only for the warm dry wind that blows from the south, and which has been the cause of so many fires. The fire of Grindelwald was caused by this type of Föhn. The wind dries up the wooden chalets, and a spark from a cigar or a kitchen fire, carried on the wind, is enough to kindle wooden buildings from which the wind has absorbed every trace of moisture. But the word Föhn is also used for the warm, damp south-west wind, which is in every way utterly different from dry Föhn. They are alike only in that both dry and wet Föhn raise the temperature and melt the snow.

I propose to call the true Föhn DRY FÖHN, and the wet, warm south-west wind WET FÖHN.

Dry Föhn is often associated with long spells of warm dry weather. The skies are cloudless, and there is no hint of rain to be seen. You know that there is Föhn in the air by a peculiar warm dryness, a marked absence of coolness and moisture in the atmosphere.

The wet Föhn always brings rain. Sometimes dry and wet Föhn will fight for the mastery. Sometimes dry Föhn will emerge into wet Föhn and bring down the rain, only to recover its mastery a day or two later.

Let us consider the effect of wet Föhn in winter proper. The ski-runner is bound to detect the first hint of wet Föhn in the air by a slight stickiness in any powder snow that he may chance to be ski-ing on. If the wet Föhn is slight, copious waxing will eliminate its effects; but if it is pronounced, the snow will ball and stick atrociously.

Föhn in Winter.

Should the Föhn disappear, it leaves its legacy behind. All slopes of powder snow which have been affected are covered with a crust, which will be more or less thick according as the thaw has been more or less severe. I assume, of course, that the thaw had been followed by the frost at night, without which crust cannot be produced. Only a new snowfall can restore a slope of powder snow which has once been melted by Föhn to its pristine conditions.

Sometimes the Föhn is so slight that the surface of the powder snow is barely touched. It is not covered by crust, but there is a suspicion of resistance as the ski drive through due to an embryo crust. Telemarks are not quite so easy, and a very fast swing is apt to throw the ski-runner outwards, owing to the fact that the side-

slip is less pronounced; for the snow gives less easily when covered by the first hint of crust. More usually the Föhn, if it once begins, is accompanied by rain. Often even in December heavy rain will fall on all slopes below 12,000 feet. Directly the Föhn disappears the usual winter frosts will convert such slopes into solid icy crust which is harder and more slippery than any marble crust produced by sun or wind. I have seen crust, formed by Föhn followed by frost, so hard that neither ski nor hobnailed boots left any perceptible trace; and on an easy slope which a beginner could take straight I have slid down helplessly on my back some hundred yards, only to be saved from a further and probably fatal fall by a guide, who thoughtfully received my head in the pit of his stomach, breaking a thumb in the effort to arrest me.

That was an extreme case of ice crust produced by Föhn, but it is not uncommon to find every slope below 10,000 feet covered by an icy crust, on which ski-ing is impossible. The wise ski-runner climbs on crampons, and selects a due south slope for the descent, and times his descent for midday. The slight surface softening produced by the sun is usually enough to produce superficial stickiness, which gives capital running, provided that you have mastered the Stemming turn and Christiania. But, except at or near midday, and except on south slopes, ski-ing is impossible during such periods.

Sometimes good ski-ing is obtained near stream beds when all other slopes are covered by hard crust. The mist that rises from the stream bed descends in hoar frost and covers the crust with a layer of crystals deep enough to take a turn. But such slopes are scarce.

Occasionally the wet Föhn is followed by a period of dry Föhn.

In this case the frost at night is much milder, and you will often find instead of marble or icy crust typical spring formations. I have found perforated crust and even film crust in January, when a period of dry Föhn with high temperatures by day and mild frosts by night had followed two or three days of rain.

For weeks together I have known the crust formed by dry Föhn to resemble perforated crust, but formed of a much smoother and more slippery texture. Imagine a hard surface pitted by numberless smooth little round hollows about the size of half-crown pieces. This type

of hard perforated crust gives good running, but calls for a thorough mastery of hard snow turns.

Often the dry Föhn produced a surface-melting to a depth of two or three inches—*typical spring conditions in midwinter.*

This again is an illustration of the law stated on p. 414: "The milder the frost the better the crust." In other words, once the snow in midwinter has been thoroughly spoiled by thaw followed by frost, the ski-ing will be best when the conditions approximate as nearly as possible to those characteristic of spring.

Spring snow is quite common in winter when dry Föhn follows wet Föhn, and the wise ski-runner will seize every chance of securing spring conditions once he has despaired of proper winter conditions. He will choose south slopes instead of north slopes, low altitudes instead of high altitudes, and time his descent for the sunny rather than the shady hours. "The milder the frost the better the crust." From which it follows that the lower the altitude and the drier the Föhn the better the ski-ing—once normal winter conditions have been interrupted.

It is most interesting to observe how the same slope will be composed of typical spring crust one day and of impossible slippery winter marble crust the next day. The difference is solely due to the fact that, in the first case, the night's frost had been mild, and in the second case severe.

After Föhn you will often, for instance, find a queer kind of surface, called Foam crust, composed of innumerable overlapping edges, miniature cornices formed by a little trickle of water, a mere drop, which has run off a thin small eave of snow. Now hard frozen foam crust is very unpleasant, but directly the dry Föhn gains the mastery, and directly the hard foam crust is exposed to a hot sun and a hot dry Föhn atmosphere, it immediately softens, and yields very fine ski-ing not unlike the best Telemark crust.

To summarize the effect of Föhn in WINTER:

Wet Föhn followed by frosts produces a crust on all slopes which have been exposed to thaw. If the Föhn is very pronounced, and is accompanied by rain, which is followed by frost, all slopes will be covered by a hard solid crust.

If a period of normal cold winter weather sets in,

this crust will be very hard and very slippery, and will only yield good ski-ing on south slopes exposed to the sun.

If the wet Föhn is followed by dry Föhn, you will get spring conditions at any rate at low altitudes—a hard crust, smoother but not unlike perforated crust, in the early morning, and a soft crust, not unlike Telemark crust, on south slopes when the sun is shining on them.

Föhn in Spring.

The Föhn is less deadly in spring, because snow which has been crusted by Föhn and frost is remelted by the sun, and the sun and frost together will always produce the same surface, whatever has gone before. A wind-swept slope or a Föhn-crusted slope are affected in precisely the same way. In winter Föhn spoils all snow that it has affected, and, save for the lucky accident of dry Föhn, one has to wait for a new fall till normal winter conditions are restored. But in spring, once the Föhn has ceased, a single sunny day followed by a single cold night's frost is sufficient to produce the normal spring conditions, hard crust in the morning passing through the normal transformations of the spring day.

Wet Föhn is, however, most unpleasant in spring while it lasts. If you are caught by wet Föhn in a club hut you are imprisoned till the Föhn passes, for the wet Föhn brings down the avalanches on every slope above 23 degrees (see p. 430). Ski-ing, while there is a touch of wet Föhn in the air, is always unpleasant. Snow which has been melted by the sun in a dry atmosphere never entirely loses its crystalline formation, excepting at low altitudes in the very late spring. And even then sun-melted snow is never so unpleasant as snow melted by the Föhn. The Föhn disintegrates the snow, destroys the crystalline formation, reduces the snow to one uniform heavy mass.

Such snow does not stick *in spring*, provided it has been through the usual process of melting and refreezing on previous days. But though the spring Föhn does not produce stickiness, it gives the snow a dragging, clogging grip. It may not 'ball' under the ski like sticky snow in winter, but on all but steep slopes it makes ski-ing desperately slow. Uphill work is most trying, for the friction between wet Föhn snow and the ski is very marked. The ski have to be thrust through the clinging surface, and the wet Föhn not only affects

the snow, it affects one's whole body and produces a general sense of lassitude.

Summer Snow

Between July and the end of September the snowline climbs ever higher. The snow above this snowline obeys the laws that we have tried to explain in the preceding pages. Snow is transformed into crust by the action of sun or thaw or wind, and the crust itself affords good or bad ski-ing, according to the conditions under which it has been produced and the conditions that affect it when once it has been formed.

In the summer you will meet with every type of snow in the High Alps. After a fresh snowfall the snow will often remain powdery for days on northern slopes at great altitudes. Between July and the beginning of the winter you will find typical winter snow, powder snow or wind-driven snow: you will find typical spring snow, such as film crust or perforated crust, but you will not find any type of snow which can fairly be described as mainly characteristic of the summer. The conditions in July and the first half of August will approximate to those of June, though of course there will be far less snow in August than in June. Towards the end of September the snow conditions will approximate to those of the winter proper, with the important difference that the snow at the end of September approaches a minimum.

Once the ski are left behind and the final climb begun on foot, there will be many complex and difficult problems of snow craft to solve which, however, hardly come within the scope of pure ski-ing. Of these the most important is the problem of safety. Once the ski are left behind, the climber's interest in the snow is reduced to two main problems: Is the snow hard enough to make going easy and yet not so hard as to need step-cutting? Is the snow safe or will it avalanche?

The avalanche question will be treated in its proper place. Summer Ski-ing will be dealt with on pp. 468–470.

I have tried to condense this section, and, like all condensed and theoretic writing, it will no doubt prove rather dull reading. In the later sections I shall try to provide concrete illustrations of the principles here

explained, and to show how the laws of snow craft may be applied in order to get good ski-ing in the months of the alpine calendar.

Snow Avalanches

Snow avalanches may be classified either as *Ground avalanches* or as *Superficial avalanches.*

Ground avalanches—the 'Grundlawinen' of Continental writers—may be defined as avalanches in which the entire snow surface is stripped off a slope, revealing the underlying earth, grass or rock.

Superficial avalanches may be defined as avalanches in which a layer of snow, more or less deep, slides off an underlying layer of snow or ice.

Before proceeding to discuss avalanches in general, and to analyse more exactly the various subdivisions of these two principal categories, it is essential to analyse the primary conditions that produce avalanches. *Primary conditions* may be defined as those which exist before the snow has covered a slope, originally bare of snow. These primary conditions are the *contour* and *gradient* of the slope and the *nature of the surface* that underlies the snow.

No avalanche has yet been observed on slopes whose gradient is less than 23 degrees, though, of course, even level slopes have often been overwhelmed by avalanches falling from steep slopes above.

Other things being equal, the stability of a snow slope depends not only on its gradient, but also on the gradient of the slopes just below and the slopes just above.

A concave slope, for instance, which has an even outflow so that there is no sudden change of gradient and so that the steeper slopes merge gradually into gentle slopes and these gentle slopes into a level outrun, is infinitely safer than a convex slope the higher portions of which are more gradual than the lower portions below. Slopes that steepen suddenly below a comparatively safe gradient should always be treated with great respect.

A slope, whose gradient would be perfectly safe if the slope petered out gradually, may be highly dangerous if the gentler slope ends suddenly in a steep slope, for the snow on the gentle slope is, so to speak, 'in the air.'

It has lost the natural support which is afforded by a gradual concave base leading out on to the level, and there is a reasonable chance of the weight of the snow on the safer slope proving just too much to stand the strain at the point where the slope steepens. In general concave slopes are safer than convex slopes, and slopes where the gradient steadily diminishes towards the base are safer than those in which the gradient increases before the base is reached. Of course, any slope overhanging a cliff is always to be treated with very great care, as even a superficial snow slide which would be quite innocuous if the slope ended on easy safe ground may prove fatal if it carries the ski-runner to the edge of a cliff below.

The chance of surviving an avalanche depends greatly on the nature of the ground where the avalanche comes to rest. Many ski-runners have escaped unhurt after being carried down several hundred feet because they have managed to keep on the surface of the avalanche and because the avalanche has gradually spread out fan-shaped on open, gentle slopes. But an avalanche falling into the bed of a narrow V-shaped valley with steep sides is almost certain to prove fatal, for the victim of this avalanche will be buried by the snow falling above, and this snow will fill up the narrow bed of the valley and freeze solid instantaneously by pressure. Thus all narrow valleys such as the Urbachthal, or the upper Rhone valley between Gletsch and Oberwald, should only be ascended when the snow is thoroughly safe.

An analogous case is where a tributary ridge runs across a hillside. An avalanche falling down this hillside will pile itself up against the tributary ridge and a ski-runner will probably be crushed below the avalanche, squeezed in between the tributary ridge and the main slope. Often a large moraine fulfils these conditions, so that an avalanche falling from a neighbouring slope is arrested at the moraine and piled up against it.

Similarly, if you are caught by an avalanche while ascending a gully, your chance of escape is much greater if the gully widens below the point where the avalanche overwhelms you. If it contracts, the pressure of the snow forcing its way through a narrow space may crush you to death. Compare the account of the avalanche that killed Bennen quoted in *Scrambles in the Alps*.

The bottom of a valley is not only dangerous for reasons just stated, but also because the stream at the bottom of a valley often exercises, especially in spring, an undercutting effect on the snow slopes that end in the stream bed.

The nature of the underlying surface, apart from its contour and gradient, is a factor of vital importance, especially in the early winter and in the spring. At intervening periods most avalanches are superficial, and slide from an underlying surface of hard snow; but in the early winter and in the late spring the whole snow slope slides away, so that the nature of the underlying surface and the probable support that it affords is of great importance.

Steep grass-slopes form a dangerous under-surface, especially where it is never or seldom mown; for long unmown grass generally lies facing downwards, and offers a most slippery surface.

Grass which is regularly mown is usually short and stubby in winter, and gives better purchase to the snow. A slope covered by stony boulders, bushes or trees is usually fairly safe, though a big avalanche, once it is fairly under weigh, will sweep over shrubs and even over small trees. Fairly dense wood may usually be considered as safe, provided one avoids the long open clearings made by old avalanches, which so often run down the middle of a forest.

An elementary knowledge of geology is useful; the excellent geological maps published by the Swiss Survey can often be consulted with benefit. Rocks which suffer much surface disintegration provide a better purchase for snow than very hard and consequently very smooth rocks. The hard 'Hochgebirgsalk,' an alpine variety of limestone, which is very common, especially in high regions, is slippery, and instead of disintegrating gradually, as gneiss or granite disintegrates, has a habit of breaking away along vertical and horizontal joints.

The common rock known as 'Flysch,' common in the lower Alps, provides a much safer surface.

Glacier-polished rocks are, of course, especially dangerous, and the whole Grimsel region is consequently swept by avalanches throughout the winter.

The lie of the strata is an important factor. Where, as is usually the case, the strata are inclined, one slope

of a mountain will usually be safer than the other. Diagrams I and II represent the north and south slopes of a ridge running more or less east and west. The ridge is formed by parallel but inclined bands of strata. Rock climbers know that the slope in Diagram I, though of the same gradient as the slope in Diagram II, is very much more difficult to climb. It is also much more liable to avalanche, as the outcrop of the strata provide a natural check to avalanches in Diagram II ; whereas in Diagram I each outcrop forms a small steep snow slope quite unsupported. If the outcrops are of reasonable breadth, there will be belts running across the face of the slope at A′, B′, C′, D′ which will be inclined into the slope, and provide a safe line of traverse ; whereas

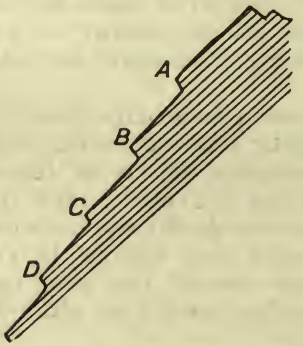


DIAGRAM I.

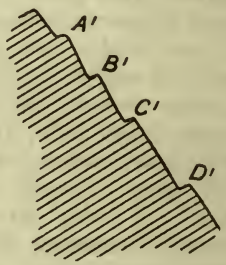


DIAGRAM II.

there is no safe line for a ski-runner desiring to traverse or ascend the slope A, B, C, D.

Geological maps indicate the 'strike' of the strata, and therefore provide useful clues as to the varying liability of slopes to avalanche.

Loose scree guarantees the ski-runner against ground avalanches, but, as the winter advances, loose scree is soon covered with deep snow, from which later layers of snow can slide uninfluenced by the underlying scree. In fact, as the winter advances, the original underlying surface plays a smaller part in the problem of avalanches. Hard-crusted snow covered by soft snow is especially dangerous, and of course ice, as is so often met with in the High Alps, is the worst under-surface of all. Fortunately, snow often attaches itself firmly to ice, transforming an ice slope into a snow slope.

The conditions necessary for this transformation will be explained on pp. 426–427.

So far we have dealt with *primary* conditions, the nature of the ground before the snow has begun to fall and the gradient of the slope from which the avalanche slides. An important factor is the *quantity* of snow on the slope. It often happens that a shallow superficial layer detaches itself and carries a ski-runner down the slope. If the slope ends on gentle ground, no damage is done beyond the loss of height and the consequent waste of time and effort in reascending to the spot from which the avalanche started. But if the snow slide carries the ski-runner over a cliff or into a bergschrund or crevasse, it is clearly immaterial to the ski-runner whether his original snow slide was 1 inch or 6 feet in thickness.

I propose to use the word SNOW SLIDE for such small avalanches as are only dangerous where they carry the ski-runner on to dangerous ground, such as the edge of a precipice, and to reserve the word AVALANCHE for avalanches deep enough in themselves to overwhelm and possibly to kill a ski-runner.

Though a very small layer of snow—an inch or even less—is enough to produce a snow slide, especially if the shallow layer rests on ice, the amount of snow necessary to produce a real avalanche is much greater, and varies very much with the quality of the snow.

Classification of Avalanches

The old writers divided avalanches into 'Grundlawinen' (ground avalanches) and 'Staublawinen' (dust avalanches)—a misleading classification, for a ground avalanche may be composed of dry powder snow, and produce all the appearance of a 'Staublawinen': the clouds of white snow dust, once supposed to be peculiar to avalanches of powder snow, are really common in almost every type of big avalanche, especially where the avalanche falls over steep cliffs. I prefer to divide snow avalanches into four main classes:

I. Dry powder avalanches.
II. Wet new snow avalanches (i.e. powder snow which has begun to thaw as differentiated from old wet snow which is formed by crust which has been thoroughly melted).

III. Snow-slabs.
IV. Wet old snow avalanches—the Grundlawinen of the older authors.

I. Dry Powder Avalanches.—Newly fallen snow, which has not been subject to thaw or sun, contains a great deal of air until it settles, and even when it has settled it still imprisons a considerable quantity of air. This makes for stability, for snow is less likely to avalanche when it lacks cohesion. I have often experimented on newly fallen snow at a low temperature, and I have found it almost impossible to start an avalanche on any slope below about 35 degrees and less than about 200 feet in height. Small snow slides are common enough if the underlying surface is hard; but as a rule even snow slides come to a standstill after a few yards. The really dangerous dry powder avalanches only occur on very long and steep slopes, where the amount and mass of the snow is sufficient to produce the necessary momentum for a big avalanche. Dry powder has a strong internal friction, and, as a rule, some powerful external impact is necessary to start an avalanche. Of such impacts wind is the most dangerous. A sudden blizzard may convert a valley, safe when the ski-runner entered it, into a veritable death-trap. Further, the fall of an avalanche on one side of a valley may precipitate other avalanches on the opposite side. Partly owing to the air imprisoned in dry powder, and partly owing to the momentum of the avalanche itself, the wind caused by a big fall of snow is extremely powerful and destructive. Houses and trees are torn away by the blast, even though they may be beyond the track of the avalanche. The force of the wind is multiplied manifold when the avalanche falls into a constricted space, such as the floor of a narrow valley. I have seen a bridge just below Gletsch destroyed by a spring avalanche, or rather by the wind caused by an avalanche on the opposite side of this very narrow valley. A large part of the bridge, weighing several tons, had been thrown *upwards* to a height of about 150 feet!

After a heavy snowfall the danger of dry powder avalanches may last for a day or two, or even more; but as a rule two or three days of settled weather and keen frosts render most northern slopes—in winter, though not in spring—safe enough. When the powder

snow has passed into the stage known as *Crystal powder* —i.e. when the small light dry powder has been converted into crystals of an appreciable size—the danger of avalanches is very remote. On a windless day with a temperature in the shade below freezing, I should not hesitate to cross almost any slope up to 35 degrees which was covered by genuine crystal powder snow, provided that the slope petered out gradually on to the level and did not overhang a cliff.

II. Wet New Snow Avalanches. — Directly the powder snow is exposed to surface thaw, either owing to a rise of temperature or to the sun, its weight and cohesiveness increase, and the danger of avalanches is consequently much greater. Sometimes the snow falls with a temperature above freezing. This wet new snow is dangerous, but as it is also extremely unpleasant for ski-ing, few ski-runners are likely to be abroad. On the other hand, ski-runners are often tempted to cross a southern slope where the powder is beginning to melt. Snow on a steep southern slope soon gets thawed through the bottom, so that ground avalanches are quite normal in winter on south slopes. As a rule, south slopes in winter get rid of their superfluous snow in the first two or three days of fine weather. The snow that remains is thawed by day and frozen by night, so that at the end of four or five days the south slopes have got rid of their avalanches, and the snow that remains is a crust more or less hard and slippery. This crust by day may become soft breakable crust, but once it has crusted, a slope in the winter is not likely to avalanche until there is a new snowfall. A very marked rise in temperature may make a south slope that has been crusted dangerous again; but such sudden and marked rises of temperature are rare in winter.

In general, therefore, south slopes in winter are safer than north slopes. They give rise to more avalanches, but such avalanches as fall off south slopes generally fall within two or three days after a snowfall, after which a south slope is crusted and safe in winter; and though after a few days of settled weather most north slopes are absolutely safe, very steep and very long north slopes, or short steep slopes overhanging a cliff, are always dangerous. Of course, whenever the wet Föhn is blowing, or whenever there is a general thaw, *all* steep slopes, and a great many moderate slopes, become very

dangerous indeed. The effect of the thaw is to give the snow the cohesiveness and weight which it lacks in its pristine dry condition. The dampness in the air saturates the snow with moisture and increases its weight. During a severe Föhn you will often see huge ground avalanches almost as destructive as those that fall in spring. When the Föhn is blowing ski-ing is always extremely dangerous. Fortunately, it is also extremely unpleasant, or fatal avalanche accidents would be more frequent.

The dry Föhn (see p. 418) is much less dangerous. Unless it is very pronounced, it will hardly affect northern slopes in winter, though it may convert a south slope, usually covered by hard crust, and therefore safe, into soft wet and dangerous snow.

In spring northern slopes usually hold powder snow for a few days at high altitudes, and even at moderate altitudes in the early spring, such as March. This powder snow soon loses the dry, light, powdery characteristics of winter powder. Though it continues to yield excellent running, spring powder is very liable to avalanche. It is damper and more cohesive than dry powder, and therefore more dangerous. Dry powder often rests on the ground below. A northern slope will often be covered with a homogeneous layer of powder some feet in depth, but spring powder (see p. 413) invariably rests on a hard-crusted slope below. It therefore tends to slide away during the warm hours of the day, and should be treated with very great caution.

Avalanches composed of spring powder are, properly speaking, new wet snow avalanches. They must be carefully distinguished from old wet snow avalanches, for old wet snow is formed by the melting of crust, whereas spring powder is formed by the melting of powder snow, i.e. ' new snow.' Snow may be defined as ' new ' before it has been crusted, and as ' old ' when it has been through the crusting process. Thus powder snow is always ' new,' however long it may be since it fell. On the other hand, a snowfall in June may be turned into crust within twenty-four hours, and thereby become ' old snow.' Crust and soft snow formed by the melting of crust are both ' old ' snow.

Spring powder is all the more dangerous, because it yields wonderful ski-ing at a time when other slopes have been spoiled by the sun. Furthermore, as spring

powder is found on north slopes, ignorant ski-runners underestimate its danger; for it is a common fallacy among the inexperienced that south slopes are more dangerous than north. In spring the reverse is usually the case, for avalanches in spring are occasioned by the general air temperature just as much as by the sun. (See also below, p. 438.)

III. The Wind-slab.—The *wind-slab* is the most treacherous of all avalanches, the most difficult to foresee, and the most incalculable in effect.

Falling snow is usually accompanied in the High Alps, and often accompanied in the lower regions, by wind. If the wind is powerful, the falling snow is driven over exposed ridges in whirlwinds, and comes to rest on the lee-side and in sheltered hollows. In this way the snowy avenues leading to glacier passes and the more sheltered snow-fields receive more than a fair share of snow. This action of the wind, denuding the exposed ridges and feeding the hollows and lee-sides, takes place on both a large and a small scale: on a large scale, when snowy valleys are fed from the snow blown off the exposed ridges that rise out of them, and on a small scale on any slope exposed to wind which is divided by ridges, however small. Any tributary ridge on a slope across which a wind is blowing will have a wind-side and a lee-side, and will accumulate snow on the lee-side and give off snow on the wind-side. A stone wall or even a hedge provides an example of this on a small scale.

Snow driven by wind and settled on lee-sides may either be more or less powdery, a denser, heavier powder than normal powder, or it may assume one of the many forms of wind-caused crust. We have described on p. 407 the various forms of winded powder, such as ripplemark, caked powder, etc., and on p. 408 the various forms of wind-formed crust, such as windboard and *Skavla*.

In general, the greatest caution should be exercised when crossing any slope which has accumulated much wind-driven snow. Wind-driven powder snow is heavier and more adhesive than ordinary powder. It is more detached from the underlying surface, and is much more conducive to avalanches. The ski-runner should keep his eyes open for traces of wind action, and when he finds snow which has obviously been exposed to severe

wind, he should exercise the greatest possible caution on crossing over to the lee-side of a ridge dividing slopes, whence the snow has obviously been blown away, from slopes where the wind-driven snow may have fallen back to earth. Wind-driven powder may in turn be covered by a new snowfall, which adds to the difficulties of diagnosing the avalanche risk.

So far we have been dealing with wind-driven snow which still retains some suggestion of powder, which is soft and dense and caky. A still more treacherous and dangerous wind formation is the wind-slab, or 'Schneebrett,' of Continental authors.

Windboard, as already explained (p. 407), is a hard, slippery crust formed by wind. Windboard is common on glaciers in the winter months, and though disagreeable to ski on, it is safe enough in most cases. Sometimes, however, this windboard, instead of being homogeneous with the underlying snow, is loosely attached, and in places forms a vault with a hollow space between the windboard and the snow beneath. The windboard is, then, properly speaking, a wind-slab. The wind-slab, or, as some writers prefer to call it, the snow-slab, is formed by wind-driven snow, which eventually settles into a hard crust. As the wind-drifted snow is of a different density to the snow on which it settles, it tends to form a distinct stratum from the underlying snow. In winter the temperature is usually considerably below freezing, so that snow which falls, or snow which is drifted by the wind, cannot bind with the snow below. In order for two strata of snow of very different density to form a homogeneous whole, there must be a period when the temperature is just above freezing in order to produce the melting followed by frost, which is a necessary factor in the fusing together of two successive layers of different types of snow.

The wind-drifted snow, ultimately transformed into a hard crust, is then of a different density to the snow below, to which it is loosely attached. This underlying snow may be either soft snow or hard crust; in either case the wind-slab forms a covering layer insecurely attached to the foundation snow. This superficial layer is subject to different strains from those which affect the underlying snow; for the tension due to the expansion and contraction which follows changes of temperature

affects the layers formed of snows of different density and character in varying ways. The surface layer, or wind-slab, may contract more obviously than the snow below, so that if the slope is concave in shape, the wind-slab, in contracting, tends to form an arch above a more or less shallow vault.

There is little if any surface indication to betray the fact that the wind-slab is not homogeneous with the underlying snow; the ski-runner may cross some such slope without the least suspicion that the hard, slippery crust is not quite so solid as it appears. Suddenly he will hear a sharp cracking noise; the hard crust will settle under him and cave in; the crust cracks along the line made by his ski, and the whole slope comes down on top of him in a cataract of tumbling blocks. The strata formed by the wind comes away, tearing with it much of the soft underlying snow, and pours down in a floor of hard, icy blocks of snow.

The wind-slab is the most dangerous and deceptive form of avalanche. Its hard polished surface gives a false sense of security. The temperature is no guide, for wind-slabs can avalanche at any temperature. Indeed, extreme frost tends to make the wind-slab more brittle. It can avalanche after days or weeks of fine weather when all the more obvious avalanches have fallen. Lastly, this wind-slab is to be found in the natural line of approach to glacier passes, in the long sheltered avenues that collect the snow blown off the exposed ridges.

It is of primary importance to distinguish most carefully between the crust formed by sun action and the crust formed by wind. A south slope crusted by sun followed by frost will never avalanche so long as the crust remains unmelted. Sun-formed crusts never avalanche. A careful study of south slopes will soon teach the ski-runner to recognize crust formed by sun and to distinguish it from crust formed by wind. The wind-slab is usually patchy, granulated, and often betrays the action of wind by a slight rippled appearance. The expert can detect wind-formed crust and can distinguish it from sun-formed crust.

The contrast between crust formed by sun (or by any process of alternate melting and frost) and crust formed by wind is instructive. The fact that the

former is safe and the latter often dangerous is due not to any surface differences but to the difference in the nature of the connection between the under-surface of the crust and the underlying snow.

Sun-formed crust always merges gradually into the underlying snow. There is no sharp plane of cleavage. The hard crust merges into softer crust; the softer crust into soft snow. There is often, of course, a plane of cleavage between two successive falls of snow—the upper layer may be soft snow resting on crust; or it may be snow which is superficially crusted resting on crust. And directly the sun melts the superficial crust there may be danger. But so long as crust formed by alternate melting and frost remains unsoftened by the sun, it may be deemed to be absolutely safe so far as avalanches are concerned, for this sun-formed crust will merge gradually into the snow immediately below it.

Wind-formed crust is, however, often sharply separated from the snow underneath it. Wind-swept crust may overlie powder snow with no intervening and softer crust to act as a binding influence. The crust may be absolutely separate, susceptible to different strains and tensions, and forming the shallow vault described above.

Should you suspect a wind-slab, sound with the ice-axe, and try to discover whether the snow is homogèneous or rests on a soft streak of snow below. If, at the border of the dangerous slope, a sharp stamping with your ski produces a settling noise, followed by the breaking away of detached fragments of snow-slab, you will know that the slab is probably insecurely poised on a shallow vault below.

Wind-slabs are, fortunately, not very common. They can only exist under winter conditions, heavy snow-falls, severe wind and comparatively weak sun action. After April, for instance, the formation of a wind-slab would be impossible, for the May sun is strong enough to melt any crust formed by wind or by any other action. In summer they are uncommon excepting under unusual conditions. They sometimes occur in late summer, when the sun has lost much of its strength and is no longer powerful enough to thaw snow which has been converted by wind into a wind-slab.

IV. Old Wet Snow Avalanches.—For the distinction between old wet snow and new wet snow, see p. 427.

Old wet snow avalanches are very common in spring. The snow, which has been melted and frozen, and remelted again and again, gradually becomes denser and heavier. As the spring advances the power of the sun becomes very great. In the afternoon, and at lower altitudes long before midday, most snow slopes are saturated to a greater or a lesser depth by the melting power of the sun. Such old wet snow is of course extremely dangerous.

The great spring avalanches, the 'Grundlawinen' of Continental writers, usually select well-known tracks. Some of them have local names, and their annual occurrence is as regular as the return of spring. The long tongues of bare spaces between forests mark their track. Incredible quantities of snow are torn from the mountain side; trees are uprooted and boulders carried downwards. The avalanche comes to rest far below, and spreads out a discoloured tongue of snow-blocks, dark with the earth rooted from the mountain side, and strewn with small trees and shrubs. Sometimes, after an unusually severe winter, these big spring avalanches extend their domain, and destroy chalets, and bridges, and even villages. Roads that cross the line of these spring avalanches must be ensured against destruction by tunnels.

Superficial avalanches of old wet snow are more common than these big ground avalanches. These superficial avalanches occur daily in spring weather. The snow is saturated with water, which acts as a lubricant between one layer of snow and the harder crust beneath. Sometimes avalanches are started by the snow thawing from the ground upwards, for the ground in the late spring is warm enough to thaw the snow immediately above it. I have seen a vault one foot in height between the ground and the overlying snow.

The power of avalanches is best appreciated by those who have visited the Alps in May. It is an interesting, if annoying, experience to be confined to some high alpine club hut in May by a sudden invasion of Föhn. If the club hut can only be approached over steep ground or up a steep and narrow valley,

there is nothing to be done but to wait till the Föhn disappears. Hardly a minute passes without an avalanche falling off some near or distant slope. The roar of big avalanches is varied by the hiss of the smaller snow-slides. Thousands of tons of snow are removed from the steeper slopes every hour.

Old wet snow avalanches are much more deadly than avalanches formed of new snow. Newly fallen snow weighs about 1½ cwt. the cubic yard. Old wet spring snow weighs about 15 cwt. or ¾ of a ton the cubic yard—in other words, ten times as much as newly fallen snow.

Furthermore, if you are overwhelmed by old wet snow, you will find the very greatest difficulty in freeing yourself, even if you are only covered by a layer a foot or so in depth. Powder snow contains a great deal of air, so that you can live for some time even if buried in a powder avalanche, but the wet spring snow contains nothing but water, and suffocation is a matter of minutes.

Whenever the Föhn blows in spring, all slopes above a very moderate degree of steepness immediately become extremely dangerous. In normal clear weather there is a frost at night, so that any slope, however steep, can be crossed without fear of avalanches between sunset and dawn. As soon as the superficial soft crust begins to form on the wet snow all danger of avalanches disappears.

On the lower slopes in May, the interval after the dawn during which a steep slope may be crossed with safety varies greatly. In May hard crust softens with surprising speed, and after 9 a.m., or even earlier, the risk of avalanches below the glacier level soon becomes formidable.

A vital distinction must be drawn between the kind of softening that is produced when a solid homogeneous crust softens superficially, and the melting of a superficial layer or crust resting on an older crust below. The second case occurs when a layer of soft snow, or of crust, rests on the older strata of crust. Once this new layer has melted it is very liable to slide off from the older layer below. On the other hand, a homogeneous crust softening superficially is usually safe enough so long as the underlying crust remains hard. Telemark

crust, which is crust softened superficially so that Telemarks are easy (p. 415), is usually safe.

The great danger is the existence of a layer of crust formed by a recent snowfall resting on an older layer. I was once climbing the steep slopes that lead from Zinal to the Mountet glacier. It was on the last day of April, and the sun had just struck the slope. The local guide was leading, and I ventured to suggest a detour to avoid a traverse across a slope that had begun to soften. He ignored the risk, and proceeded. I remained behind and watched him. Suddenly a layer of snow about six inches in thickness, which had softened down to the old hard crust beneath, slid away with startling rapidity. The guide gave a small jump, and got his ski into the old layer, while the softened snow slid away and disappeared over the cliff below. The guide's top ski had cut through to the old layer before the snow slipped, otherwise he would have been killed.

In May in the High Alps the risks of such avalanches is small on all save very steep slopes. Most of the big spring avalanches fall below the limits of the summer snowline. They slide off slopes which are bare of snow in summer. Once the region of the *névés* is reached the danger is very much less, though of course by no means non-existent, especially when the Föhn is blowing. The May ski-runner must often time his ascent to a club hut to arrive in the early hours of the morning, and wait for his descent from the glaciers to the lower valleys for the hour after sunset.

As the winter advances the danger from avalanches increases, not only because the quantity of snow increases and because the sun is more powerful and the temperature higher, but also because the inequalities on the underlying surface gradually disappear. Scree, small boulders, shrubs and other natural checks to the flow of an avalanche vanish in the ever-deepening snow. Roads and small shelving plateaus, which break up a steep slope, get buried. Each succeeding avalanche leaves some of its burden on all protruding shelves, and thereby tends to smooth out the mountain side, creating, in place of a slope broken by inequalities, one long, even flow which presents no hindrance to the avalanche. Thus big avalanches tend to take the place of the smaller avalanches which fell down part of the

slope, only to be arrested at some convenient terrace, such as a road or small plateau.

In the spring avalanches often fall right across rivers, which very soon form a tunnel beneath the snow-bridge of the avalanche. Such snow-bridges should be crossed with caution. More than one ski-runner has been killed by breaking through the remains of an avalanche into a river.

It is a common illusion among the inexperienced that north slopes are safer than south slopes in spring. They are not—in fact, north slopes are more dangerous than south slopes. In spring it is the general air temperature which determines the fall of avalanches. True, the south slopes avalanche first, and for this reason north slopes hold much more snow, so that when they finally get rid of their superfluous snow they produce far and away the most destructive avalanches. Of course in spring the sun shines on all slopes, and it shines with quite sufficient force even on due north slopes to produce an avalanche. In fact, the really great spring avalanches are those which fall from northerly slopes.

Summer Snow Avalanches

During the summer months, as already explained, every type of snow can be found in the High Alps from pure winter powder to the numberless varieties of spring crusts and spring soft snow.

It follows that avalanches in summer obey the same laws as in spring. There are far fewer avalanches in summer than in spring, for there is far less snow to fall. Quite enough, however, is left to make the avalanche problem of vital importance for the ski-runner and the summer climber.

The various types of avalanches described in this chapter are not confined to winter or spring, with the possible exception of the wind-slab avalanche. I should have said, a priori, that wind-slab avalanches were peculiar to winter and the early spring, for they depend for their existence on snow falling at a very low temperature, and on the snowfall being followed by strong and cold winds before the sun has time to melt the snow and to bind it into the underlying surface. I am told

by Mr. Young that he has seen wind-slab avalanches in summer—probably, I should imagine, in the very late summer or early autumn, when the conditions begin to approximate to winter conditions. Apart, then, from wind-slab avalanches, which must be very uncommon in summer, all the other types are by no means unusual. Avalanches of powder snow, of old wet snow and new wet snow can occur at any month of the year.

It is not necessary to give separate rules for summer and for spring. The important factors in the problem are not so much the season as the amount of snow that has fallen, the temperature, the angle of the sun, etc. etc. If the reader thoroughly understands avalanche craft in winter and in spring, he should be able to cope with the same or with similar problems in summer.

The majority of fatal avalanche accidents in summer are due to snow slides. I have for convenience' sake adopted the arbitrary distinction of avalanches into avalanches proper—those which are dangerous owing to the weight and quantity of the snow that falls—and snow-slides, which are only dangerous in so far as they carry the climber or ski-runner with them over a cliff or into a crevasse. Most summer avalanche accidents are due to snow slides, and occur in places which the ski-runner could not reach on ski. Snow resting on ice in gullies, or snow resting on smooth slabs, etc., are frequent causes of fatal accidents. Such avalanches or snow-slides have been described by Mr. Young.

The classical device for testing whether snow is resting on ice—i.e. throwing a big rock down the suspicious slope—is often of use to a ski-runner who is in doubt whether to descend a doubtful slope on ski or on foot.

Tactics on Avalanche Ground

The simplest rule is to avoid avalanche ground. Unfortunately, this is not always possible. The limits of danger are so wide that one may occasionally find oneself on a slope which might conceivably avalanche. Such a slope may provide the only possible means of getting down to the valley, so that the choice is not merely between giving up an expedition or risking an

avalanche, but between the certainty of a night out if one recrosses the pass and the possibility of an avalanche.

It has sometimes been asserted that a ski-runner could escape an avalanche by turning his ski downhill and making a sudden dive downward. Of course this is wildly absurd. I have only once been caught in an avalanche, and, long before I could have turned my ski downhill, the avalanche had carried me some twenty yards downhill. An avalanche does not start by a kind of snowball action. It starts with a sharp crack, and the sudden sliding away of a deep layer of snow. Watch snow sliding off a roof and you will understand that an avalanche is very sudden and overwhelming. Almost every avalanche leaves a clean line of cleavage behind—a wall of snow which is exactly as deep as the avalanche at its birth.

The chance of escaping an avalanche by flight is infinitesimal if you are near the point where the avalanche starts. You are lucky if you have time enough to kick your ski off, and you will only be able to do this if you have unloosened the bindings previous to crossing the dangerous slope. There will be no chance of unstrapping them once the avalanche is upon you. If you cannot kick them off instantaneously, they will remain attached to you.

Your chance of surviving is very much greater if you can get rid of your ski, for the ski drag you under, and prevent all hope of fighting your way to the surface of the avalanche. Once you are overwhelmed you should adopt a swimming motion. Above all, try to keep your head uppermost. A vigorous swimming motion with the hands is said to be useful by people who have survived.

Dangerous slopes should always be crossed as high as possible. An avalanche is much more dangerous if it overwhelms you from above than if it starts from the immediate neighbourhood of your ski. Steep slopes below a cliff usually yield a fairly safe passage just below the rocks, for there is often a little gap between the edge of the snow and the rocks which affords a secure route. Take advantage of every belt or shelf of gentler ground that may run across a steep slope. Traces of old roads or even of footpaths are better than nothing.

Clearly a man on ski is much more likely to start

an avalanche than a man on foot. I have often been surprised to see chamois-tracks down slopes 40–50 degrees steep. It is true chamois occasionally get killed by avalanches, but they certainly possess a great immunity. The reason is obvious. The chamois' slender hoofs sink in very deeply. They penetrate right through the snow to any hard underlying crust that there may be beneath. Further, the chamois does not, like the ski-runner, cut the snow by a continuous line which divides the slope in two, and deprives the snow above the ski-tracks of much of its support. Chamois-tracks form a row of small holes, and therefore have a much less unsettling effect.

A man on foot has some of the advantages of the chamois. He is at least much safer than on ski. His feet get down to the old crust below unless the soft snow is very deep. On ski it is extremely easy to start a small superficial avalanche or snow-slide; and on ski it is very difficult to check such a small or big avalanche once it is started. The ski may sink just into the superficial layer and help to detach it.

On dangerous ground you should therefore remove the ski and proceed on foot. If possible, tackle such slopes by a direct ascent or descent in single file. Traversing is much more likely to cut the snow slope and start an avalanche.

Never rope on avalanche ground unless one member of the party can remain on safe ground, i.e. a cluster of rocks, and secure the man who is traversing a short stretch of dangerous snow. If two or three ski-runners are caught by an avalanche while roped together, their chance of escape is slight, as the rope tends to get caught, to drag them under the snow and to suffocate them.

Dangerous ground should, of course, be crossed by only one man at a time.

It has been suggested by an experienced mountaineer that each member of the party should drag behind him a long thin red cord, which would provide a clue to the whereabouts of a man who had been buried by an avalanche. The ski-ing mountaineer's kit is already so overcharged that few people would be likely to add to it for this purpose.

For the descent of dangerous slopes, if the party do

not proceed on foot, they should put on their sealskins, so as to run the slopes as steeply and directly as possible.

The ice-axe should always be driven in as far as possible, so as to find purchase in the underlying snow. Ski-sticks that are provided with removable disks are very useful, as they can be driven in much deeper than ordinary ski-sticks.

When in doubt, sound with an axe or stick and try to discover whether the snow is homogeneous, and if not, what lies below the surface layer and what lies below the snow itself.

When in doubt, turn back if possible. If it is necessary to proceed, take off your ski. If speed is important, keep on your ski; and if you are descending, put on sealskins. If you cannot spare the time to put on sealskins, sit on your ski and descend by a sitting ski-glissade, which is, by the way, a knack in itself.

The High Alps in Winter

Weather Conditions.

The weather after the New Year is usually more settled than in the summer. A spell of absolutely unbroken weather lasting from three weeks to a month or more is almost inevitable some time in January or February. As a rule, February is the finest month in the winter.

These typical fine-weather periods are often accompanied by mild weather. The temperature even by night is often surprisingly high on the glaciers, even when there is no touch of Föhn in the air. This has led some observers to claim that the temperature in winter—even in the shade—is often lower in the valleys than on the mountains. I have never seen any evidence produced for the phenomenon which has been romantically described as ' inverted temperature,' and have no reason to believe that any such violation of the laws of temperature really exists. It is often, of course, colder in the plains when the plains are covered by *nebelmeer* than in sunny alpine stations, but this is very different to any general inversion of temperature. I have, it is true, sat on the summit of the Finsteraarhorn in mid-winter stripped to the waist, and I have often been uncomfortably hot at great altitudes in the sun. But it is dangerous to generalize from such experiences,

and though on a windless day, winter mountaineering may be as warm and comfortable as summer climbing, the ski-runner must always be prepared for sudden danger of temperature, and severe cold.

The variations in temperature are surprising. A cushion of cold air, several degrees below freezing, may exist near the surface of the snow, and three feet above the surface of the snow the air may be quite mild. This is a phenomenon well known to rink-makers. In the sun the heat may be quite intense, and yet, a few yards off, in the shade the temperature may be several degrees below freezing.

A suspicion of wind may transform a mild and equable into an unpleasantly cold atmosphere. The changes of temperature are very sudden. You may be basking in shirt-sleeves on one side of a ridge, and be frost-bitten within a few minutes on turning a corner into the wind.

The great danger of winter mountaineering is the risk of a sudden change of weather. Storms seem to blow up out of clear skies with a suddenness to which summer affords no parallel. The man who is caught in a big winter storm is lucky if he escapes without casualty. A driving wind makes ski-ing almost impossible. The snow is blown into one's face, and in a few minutes one's eyelashes are gummed up with miniature icicles.

The big storms that sometimes prevail for more than a week at a time may imprison the climber in a club hut until all his provisions are exhausted. From most club huts escape is completely impossible till the storm drops. Even when the storm has given place to fine weather, retreat may be very dangerous owing to the avalanche peril.

Under fair conditions winter mountaineering is often surprisingly easy. Men who have enjoyed unbroken good luck with their weather are tempted to discount the very real dangers of mountaineering in winter, and to adopt a paradoxical attitude towards the Alps in winter, implying that the only danger to be feared is sunstroke and snow-blindness. Those who have not been so uniformly lucky realize that winter mountaineering on a big scale is a sport from which the element of danger will never be lacking; that a sudden storm may transform even an easy expedition into a desperate struggle for safety.

The Approaches to the High Alps.

Often the most difficult, and sometimes the most dangerous, part of a winter expedition in the High Alps is the first day's march to the club hut. Once the upper regions are attained, progress is usually fairly straightforward. It is quite normal for ski-runners to make nearly as good time on the ascent of a snow-peak as summer climbers, but it is very rare indeed that the club hut is reached in anything approaching summer time. From one and a half to twice as long must be allowed for the ascent to most club huts.

The long, narrow valleys that so often lead to huts are usually very deep in soft powdery snow, so that progress must be slow, whereas in the upper regions the snow is usually more or less packed by the wind, which makes for easier going on the ascent, even though the descent may be far from pleasant. Moreover, the danger from avalanches is usually much more serious in the lower regions, where the slopes are much steeper and the valleys narrower.

On the first day's march the guides will be heavily loaded, for the full equipment for a serious expedition in the High Alps is very much more bulky and weighty than that necessary in summer. In the first place, no prudent ski-runner commits himself to a High Alp tour without ample reserves of food. He must allow for the danger of finding himself stormbound in a hut for a period which may be anything from a day to a fortnight. Plenty of compressed reserve food is essential until the club huts begin to store emergency rations. Further, as a broken ski may involve serious consequences, he must burden himself with spare ski-tips and all the apparatus for mending ski. Extra clothes, plenty of gloves, and, of course, crampons add to the overburdened rucksacks. Unless one is prepared to carry very heavy sacks it does not pay to economize in porters. As a rule, you should reckon two guides or porters for every member of the party if you contemplate an expedition of some five to six days in length, unless, of course, you are prepared to carry some thirty pounds or so in your own sack for the first day. Of course, if you take two porters to the hut, they may be sent back from the hut; but it is obviously unfair to expect a solitary porter to make the descent alone.

Everything should be done to make matters easy. If the first part of the ascent lies up a path or a wood-track, a boy should be hired to carry your ski. If the ascent begins from some out-of-the-way alpine valley, it will often pay to send a guide on ahead the day before to make tracks for part of the distance in soft snow. This is especially useful if you are attempting a very big climb from one of the rather higher alpine valleys or mountain inns without using a club hut. It is unwise to reckon on climbing more than an average of 500 feet per hour for the first day.

An early start is essential. The longest days pass fairly comfortably if you break them up with frequent *short* halts and short feeds. It is often impossible in winter to make a prolonged halt owing to the cold. A few caramels or some chocolate, which can be easily got at, should be kept in one's pocket, and munched during short halts. Napoleon's rule of a short rest and something to eat every hour is a good rule for climbers, especially winter climbers who are heavily laden.

The huts as a rule are comfortable enough in winter, though the stoves often prove troublesome. Wood is usually kept in large quantities, brought up at the end of the autumn, though it is as well to make inquiries on this point before starting. On reaching the hut, set the aneroid barometer usually found in most huts. A pocket-barometer is not so reliable, for, as Whymper pointed out and conclusively proved, the usual aneroid tends to lose on the mercurial. In other words, if you carry a pocket-aneroid up some thousands of feet and then set it at the hut, it will usually fall a point during the night, where a mercurial barometer would have remained stationary.

So, too, if you descend from a peak to a hut, the pocket-aneroid will rise where a mercurial would remain stationary, thereby often conveying very dangerous and misleading information. It is most important to set the hut aneroid, so as to have some warning of the approach of a sudden storm.

If you are unlucky enough to be caught by bad weather in a hut, and if your provisions run short, you should spend as much of your time as possible lying down and keeping warm, for the less exercise you take the less food you will need. People who practise the

'fast cure' have proved that a man can go without any food for a week and carry on his ordinary business without feeling unduly weakened. It is therefore in every way better to stay at the hut fasting—even for three or four days—than to attempt to descend in a bad storm. If the worst comes to the worst, and the party is thoroughly weakened by lack of food, they can always stay at the hut and await the search party.

If a sally is attempted in bad weather from a hut which is situated among glacier snow-fields, it is advisable to cut up a number of small stakes from the firewood. These can be planted in the snow at intervals of a hundred yards or so in order that a retreat can always be made back to the hut if further advance is impossible.

Snow Conditions in the High Alps.

If the Alps were windless, the snow that falls between November and the end of February would remain powdery and unspoiled on all save very steep south slopes. At high altitudes the sun is powerless to affect the snow in mid-winter on *gentle* south slopes. The snow would remain powdery on *northern* slopes till the middle of April but for wind. Unfortunately, the High Alps are swept by wind, more especially during long spells of fine cloudless weather, during which the 'bise,' or north wind, sweeps across all exposed ridges and faces. Consequently, the snow seldom remains long unspoiled. In sheltered glacier valleys it may retain its powdery condition, but on all more or less exposed slopes it soon hardens. Of course, if an expedition is planned within two or three days of a fresh snowfall, the party may have perfect powder snow; but such snow is the exception in winter in the High Alps, whereas it is the rule in spring.

Rock Ridges and Ice Slopes.

Rock climbing does not properly come within the scope of mountaineering on ski; but so many ski-runners combine a ski tour with a final scramble up a rock ridge, such as the last arête of Monte Rosa or the Zinal Rothhorn, that some discussion of the condition of rocks and ice slopes in winter is essential.

As a rule, rock ridges are as dry, or drier, in winter than in summer. Snow that falls in summer often falls at a temperature little below freezing. It is often most adhesive stuff. The strong summer sun followed by frosts at night turns this snow into crust, or at least

into snow with a considerable power of sticking to the rocks. In summer it is often several days before the big rock peaks will go after a heavy snowfall. But in winter the snow that falls in the High Alps is light and powdery. The low temperatures and the reduced power of the sun prevent the snow melting; it retains its light powdery character, and is swept away from exposed ridges by the wind. It offers no resistance to the wind, for it is composed of light dry crystals with no cohesive or adhesive power. Consequently, the rock ridges in the winter are often freer from snow than in average summer weather, which is a mixture of good and bad. In winter, cornices have little chance of forming. In fact, if the weather is mild and the ridge windless on the day of the ascent, it is scarcely more difficult to climb a rock ridge of average difficulty in winter than in summer. South ridges are, of course, much warmer than north ridges, but they are not necessarily more free of snow; for the agent that reduces the snow on the rock ridges is not the sun—powerless as a melting agent at these altitudes in winter—but the wind; and in fine weather the wind, as often as not, blows from the north. Of course, if the north wind is blowing, a north ridge may be impossible, for the rocks promptly become extremely cold to touch, so that in general it is wisest to select south rock ridges in preference to north. None the less, rock ridges facing north, such as the north ridge of the Zinal Rothhorn or the north ridge of the Gspaltenhorn, have been climbed without difficulty in midwinter.[1]

The same causes which keep the rock ridges comparatively free from snow tend to remove any snow that may fall on to steep ice slopes.

Inexperienced winter mountaineers are often surprised to find as much or more ice on summit slopes in winter than in summer.

As a matter of fact, there is often quite as much ice on steep exposed slopes in winter as in summer.

An ice slope is transformed into a snow slope when falling snow is accompanied by a temperature just above freezing-point—in other words, when the snow is

[1] As the prevailing alpine winds blow from the west, western rock ridges and rock faces are usually more free from snow than eastern ridges. See footnote, p. 409.

very nearly sleet. Such snow adheres to the underlying ice, and by the normal process of alternate thaw and frost becomes more and more firmly attached. The next snowfall that occurs attaches itself to the underlying thin stratum of snow crust lying on ice, so that in the course of time the ice slope is covered by a compact and reliable layer of crusted snow.

But the dry powder of midwinter has no chance of finding a permanent resting-place on steep ice. The first strong wind that blows will remove it.

Many slopes vary from season to season and from month to month. Sometimes they are ice, sometimes snow. Such slopes, if they are ice in October, will remain ice until the following spring. May and June are the months in which the conversion of ice slopes into snow slopes usually takes place.

Glaciers in Winter

The light powder snow which is swept from rock and ice ridges is deposited on the broad glacier snow-fields, which therefore receive more than their fair share of snow. In midwinter there are few open crevasses to be seen, save at the icefalls, and most traces of concealed crevasses disappear from the upper *névés*. None the less, the danger from concealed crevasses is by no means trivial. The dry powder snow forms the most brittle of snow-bridges.

In the Grenz glacier accident a snow-bridge *fourteen feet thick* collapsed beneath a party of ski-runners. Of course, sooner or later, most crevasses are bridged, not only by powder snow, but various forms of wind-driven snow and wind-formed crust. Such crust is, of course, less brittle than powder snow-bridges, but it is quite brittle enough. The low temperature tends to increase the brittleness of snow-bridges.

In the early hours of a *summer* morning a snow-bridge two or three inches thick will usually be safe enough; for such bridges are generally formed of a mixture of ice and hard snow which is due to alternate melting and freezing. Such crust is much more compact, more solid, and far less brittle than crust formed by wind.

Glaciers are, in fact, safer in summer than in winter;

for though there are many more crevasses open, there are far fewer dangerous crevasses whose existence cannot easily be detected. The droop on the snow and other unmistakable signs in ordinary seasons betray most concealed crevasses to the experienced eye. In winter the winds are so powerful, and their effect is so much greater (for reasons explained on pp. 446–447), that they obliterate all traces of underlying crevasses. The surface of the snow is apparently one uniform field of wind-driven snow, and even the most expert cannot possibly detect the presence of concealed crevasses.

This raises the very vexed question of ski-ing on a rope. It is quite easy with a little practice to ski at a reasonably high speed on a rope, and to make combined swings. Roped running is, in fact, quite enjoyable, but it is not, and never can be, as enjoyable or as easy as free ski-ing. Consequently, many ski-runners will never consent to rope on the descent, save on glaciers, which are known to be badly crevassed.

There are three methods of ski-ing on a glacier:

1. *A Roped Descent.*—For the technique of ski-ing on a rope, see pp. 452–456.

2. *A Descent in exactly the same Tracks as were used for the Ascent.*—This method is based on the presumption that a snow-bridge which held in the morning during the ascent will hold during the descent. Obviously the strain is much less during the fast descent than during the climb. Also, as the variations of temperature in winter are of no great importance, provided that the temperature remains below freezing, a snow-bridge which holds in the morning should hold in the afternoon, though the same cannot, of course, be said in summer. As the tracks of the ascent were presumably made on sealskins, the descent must also be made on sealskins if it be desired to follow with any accuracy the line of the ascent and to avoid rapid swings and turns which are liable to test severely a snow-bridge strong enough to resist the ordinary uphill track. For my part, though this method is sometimes used, I consider that the necessity to wear skins and to keep exactly along one line is just as troublesome and not nearly so safe as the rope.

What usually happens when people start a descent *without* skins, but with the pious intention of keeping to the uphill tracks, is that they very soon find themselves

curving and swinging some considerable distance from their old tracks.

3. *A Free Descent Unroped.*—If you discard the rope, you should be doubly careful to reduce risk to a minimum by paying attention to the general laws of crevasse formation. The middle of a glacier is usually the safest part of the glacier in winter. Lateral crevasses, i.e. crevasses at the side of the glacier, are wider, more numerous, and more complicated than transverse crevasses. The crevasses in the middle of a glacier are usually at right angles to the line of flow, so that a ski-runner who is running straight will cross them at their narrowest breadth. Lateral crevasses usually run at an angle of 30–45 degrees to the line of flow,[1] so that they will usually be crossed by a ski-runner at a more or less wide angle, and the danger of running along the whole length instead of across a snow-bridge is therefore great.

The principal rules for glacier ski-ing in order of importance are as follows: (1) Don't fall. (2) Don't make sudden swings. (3) Run straight. (4) Don't use your stick. (5) Keep to the middle of the glacier.

In other words, run as straight as you can consistent with not falling. It is better to run straight and to use your stick to reduce your speed than to check your speed by swings and turns, for a swing to a standstill above a crevasse is more likely than any other ski-ing manœuvre to break a snow-bridge.

Keep close together on the descent, but not too close. Above all things, avoid crossing the same snow-bridge while another member of the party is crossing it. In the Grenz glacier accident three members of the party fell into the same crevasse.

Avoid short sharp turns, and cultivate long gentle turns if you cannot run straight.

It is often advisable to follow the leader's tracks, for if the leader has passed over a crevasse without falling in, the chances are that you will be equally fortunate.

There should be two ropes in the party, so that if one rope disappears with its bearer into a crevasse the second rope may be available to pull him out.

[1] As the middle of the glacier moves faster than the sides, and as the line of cleavage is at right angles to the line of tension, lateral crevasses, contrary to what casual deduction might suppose, run backwards from the side of the glacier to the centre.

At least one rope, and, in addition, the first-aid case and mending apparatus for ski, should be in the rear of the party, as nothing is more annoying than to see the leader disappearing far below with the spare ski-tip just as your ski-point has snapped off.

"Always rope on snow-covered glaciers." This is the law, and in theory the law admits of no exceptions. But in winter, as in summer, this law is often broken. Few climbers have a clear record on this point. The temptation to break the law is, of course, much stronger for the ski-runner than for the foot-climber. There have been comparatively few accidents in which ski-runners have fallen into crevasses. On glaciers that are known to be little, if at all, crevassed in summer, only a pedant would rope in winter. Local knowledge is therefore very useful indeed, and if a local guide can be taken, so much the better.

Such accidents as have happened have been either on the ascent, or during a more or less level traverse, or as the result of a sudden swing or stem which has disturbed the snow. I know of no case in which a ski-runner has fallen into a crevasse during a fast, free, unchecked descent. Indeed, I should doubt if it would be possible to break through a snow-bridge while moving fast and running straight. I have myself shot an open crevasse about ten feet or more in breadth while travelling at a fairly high speed.

Most ski-runners would rope in winter on a glacier that was known to be very crevassed in summer. Many ski-runners always rope in winter, but far more only rope when they know the glacier to be very crevassed.

In May or June there is no reason to rope for the descent, save under very exceptional circumstances. The risk of falling into a crevasse in May or June is so slight that the rope may usually be discarded.

Ski-ing on a Rope.

Ski-ing on a rope is not so difficult as the inexperienced might suppose. Experts who have practised together can attain high speeds, and perform all the turns while roped together. A couple of good runners with a little practice should be able to run safely at a fair speed. But practice is necessary, and an hour or two of roped running in the valley is well worth while.

Two is the most manageable number on a rope, and

of course, there need never be more than three, for larger parties can divide up into two twos, a two and a three, etc.

First a word as to roping. Most guides make a loop at the very end of the rope. This is quite unsound. The loop should be made about four feet from the end of the rope, and this four feet of spare rope should again be tied round the waist. Otherwise, if you fall into a crevasse, the pressure on your waist may almost suffocate you before you are withdrawn; whereas, if you have four feet of spare rope, you can uncoil this, make a new loop into which you can place a foot, thereby at once relieving the pressure on your body. With a little effort you should be able to wriggle out of the main noose, standing in what may be called the stirrup noose. If you are not exhausted, you might then be able to swarm up the rope, which would of course be quite impossible if, as would otherwise be the case, the end of the rope was originally tied round your body. Two men on a glacier alone sometimes adopt Mummery's plan of wearing a second rope, which, in the event of a fall into a crevasse, is untied by the man above and wound round the head of an axe driven into the snow. The man below pulls on to the rope wound round the axe. The man above pulls on to the rope round the fallen man's body. Thus there are virtually two men pulling one.

There is another method of roping sometimes used when three ski-runners are tied to the same rope, which —though it has been employed by experienced guides— seems to me most unsound. In this method two ski-runners are tied to one rope, along which runs a small iron ring. To this ring a second rope is fastened, and to this second rope the third ski-runner attaches himself. The theory is that the third ski-runner, being attached to a rope which in turn is attached to a movable ring free to slide on the main rope, is far less constrained in his movements than if all three were on the same rope. This is true, but I should be sorry to be the third ski-runner if I was to fall into a crevasse. Suppose the other two ski-runners are on opposite sides of this crevasse. The man in the crevasse is then attached to a rope which slides helplessly with the ring along the main rope. The iron ring probably buries itself in the lower lip of the

crevasse. I do not quite see how any tension is to be exerted on the secondary rope.

It is simpler to begin by considering the case of two ski-runners, A and B, running on a rope. If there is a marked difference in the ability of A and B, the poorer ski-runner should lead, for it is much easier to lead on a rope than to be the last man. The last man on the rope has to moderate his pace and his direction in accordance with the movements of the leader. If, however, A and B are equally good runners, then the leader should be the one whose ski are the faster: I do *not* mean the faster ski-runner, but the one whose ski are running better, either because the ski themselves are faster and more slippery, or because their owner is the heavier of the two, and therefore, other things being equal, tends to get downhill quicker. For if, on a gradual slope which is to be taken straight without braking or stemming, A (whose ski are faster) is constantly overrunning B, the rope will get mixed up with the ski, and A will have to regulate his pace by stemming or braking in order to keep the proper distance. On the other hand, if A leads, his extra speed will keep the rope taut, and the tension of the rope will enable B to keep a uniform distance.

On easy ground A and B can ski in single file. B, whose ski are slower, will be kept in line by the tension of the rope. It is not necessary nor desirable for B to follow exactly the same spoor as A: his spoor should be an inch or two to the side of, and parallel to, A's spoor.

B must be on the look out for sudden increases in pace on the part of A: A may, for instance, come to a steeper gradient, and B, if he is not on the look out, is liable to be pulled over and pitched on to his head. Similarly B, if A runs on to a gentler gradient, will have to guard against overrunning A, and thereby rendering the rope useless; for if A and B are on the same snow-bridge they may both fall in. *At least* 75 feet of rope should be allowed between A and B. On easy ground this rope may be allowed to be taut; on more difficult ground B should keep a coil of rope in his hand to allow a margin in the event of A suddenly increasing his speed.

The normal position for straight running should be

modified. In free running lateral strains may usually be disregarded ; the main risk of a fall lies in fore and aft changes of speed. Consequently, for normal running the narrow groove and the lengthened base, as in the Telemark position, are usually preferable to a broad track. But a ski-runner on a rope is always liable to lateral strains. It is rare that one runs exactly in line ; whenever one's track is parallel rather than coincident with the track of the leader, and whenever the leader changes his direction, however slightly, the rope exercises a certain amount of sideways pull. The greater the distance between the parallel tracks, the greater the lateral tension of the rope. Consequently, the ski-runner on a rope must be prepared, not only for forward and, in the case of the leader, for backward jerks, but also for sideway strains.

The best position for roped running is to hold the ski about 8 inches apart. One ski should be a few inches ahead of the other, and the knees should be loose. The body should be slightly bent below the waist. The Telemark position is, of course, most unsound.

On average ground the ski-sticks should be held together in the left hand, leaving the right hand free to hold a spare coil of rope. If it is necessary to brake or to control your speed, you should do so by stemming and not by the stick.

On difficult ground you should use the stick to control your speed—a recourse which is seldom, if ever, justified, except when running on the rope. It is quite easy to hold both the sticks and also a spare coil of rope in your two hands ; and if you intend to brake with your sticks, you must, of course, put your sticks together and get both your hands on to them. The most efficient stop turn on a rope is the Christiania helped out with the sticks. If you are unroped, a yard or two of sideslip after a sudden stop is quite a good thing, but if you are roped, you need to stop in the smallest possible compass, especially if you are leading and the man behind falls. For this purpose there is nothing to beat the stop Christiania helped out with the sticks. As a rule, however, stemming is sufficient without using the sticks. Good runners can, of course, make a series of linked turns on ski, and there are few prettier sights than a skilful party on a rope descending in a series of Stemming turns.

Whether leading or going last, always keep your partner fully informed as to your changes of speed or direction. If the back man feels that he is going to fall, he must shout out at once, so as to give the leader time to stop by a stick Christiania. Similarly the leader, if he comes to a steeper gradient, should warn his partner that the speed is likely to increase.

Be prepared to fall neatly and with the maximum of effect. Should the leader fall into a crevasse, don't allow yourself to be dragged after him. Throw yourself on the ground, and bring your ski round, as you fall, at right angles to the track and below you. This is more difficult than might be imagined. An indifferent runner, or even a good runner who had not trained himself to expect a fall, would run a big risk of being pulled into the crevasse by the first man.

The 'falling Christiania' is the best method of avoiding being pulled after the leader into a crevasse.

On fairly steep slopes it is best not to run in line. A and B should run side by side. Provided the rope is long enough (and at least 75 feet should be allowed between each partner), there is no danger that A and B will fall into the same crevasse. A and B will probably not be exactly side by side. B will be just a little behind A. In other words, the line of the rope will not be exactly at right angles to the parallel lines of the two tracks cut by A and B. This side-by-side method is much easier than running in line; if A suddenly quickens in speed, the only result is that A, instead of being side by side with B, tends to run on ahead, and the two tracks tend to close up together until the speed is readjusted. So, too, if B falls suddenly, A has much more chance and more room in which to make a stop Christiania than if they were running exactly in line. Also it is not necessary for either A or B to hold a coil of rope in his hands. If the snow is smooth, the rope need not be taut between the runners if they are running side by side. It cannot be allowed to hang loose and to sweep the snow.

All that has been said above applies equally to three men on a rope: three on a rope is, however, a more difficult combination; the position of the middle man liable to both fore and aft jerks is far from enviable. The best man should be placed in the middle. It is,

however, surprising how easily a party of three practised roped runners can execute straight running and even combined turns on a rope.

Ropes that are employed in winter should be new. Old summer ropes should not be used up in winter. Ropes break much more easily in winter than in summer, and the strain is much greater in the event of a fall into a crevasse owing to the greater speed on ski than on foot.

The High Alps in Spring

There is a fascination about the High Alps in winter that is unique. Never are the great peaks so icily aloof, the silences of the glaciers so inviolate. No moon compares with the full moon of January shining on some great glacier causeway; no views are clearer than the summit panorama of February. None the less, winter is *not* the proper season for ski tours in the High Alps. It is true that the rock ridges are usually free from snow in the winter and corniced in spring, so that for expeditions which combine ski-ing with more or less difficult rock climbing, winter is preferable to spring. At the same time, it is possible to exaggerate this point. An ardent champion of winter mountaineering once cited to me the Lyskamm as a mountain that could not be climbed in May owing to cornices. Unfortunately for his case, the Lyskamm *had* been climbed in May. I have known the cornice on the Wetterhorn almost invisible in May, whereas in many winters it is quite formidable.

Still we may concede that rock ridges are certainly far easier in February than in May, and cornices in general much larger in spring than in winter.

And of course the snowline is lower in winter than in spring; but, as we shall try to prove, this is not of very great importance.

The winter is the season for ski tours of modest length. It is the season for what may be called *sub-alpine* ski-ing. (We need some handy expression in English for the most useful German word *Mittelgebirge.*) Spring, on the other hand, is eminently suitable for ski tours in the High Alps.

The best month for glacier ski-ing is May. June is also excellent. Indeed, from about the middle of May

to the middle of June is, on the average, as good a month as any in the year for glacier ski-ing.

February is usually the best of the winter months, and May is the best month for spring ski-ing. May is, among other things, usually fine. April is almost always stormy; but the weather usually mends at the end of April, and a long spell of perfect weather is as common in May as in February.

Let us then compare ski-ing among the glaciers in May and in February from the point of view of (1) Safety; (2) Quality of ski-ing; (3) Effort; (4) Scenery.

(1) *Safety.*—The shortness of the days and the great variations of temperature, from mild and equable to bitterly cold, all add an element of danger to the High Alps in February. A small mishap may have very serious consequences. A broken leg half-way down Monte Rosa or the Wetterhorn probably means a night in the open, and a night in the open may mean a fatal ending. The sudden changes of weather, the storms that rise in a night and last for days, all make February ski-ing among the glaciers a sport with its own dangers. In May all these risks are reduced almost to vanishing-point. A broken leg is a broken leg in February or in May, but a night in the open in May should have no permanent effect on any but a very badly wounded climber.

We have already dealt with avalanches. Here we need only repeat that though avalanches are of daily occurrence in May, an experienced party has no difficulty in avoiding them. They have a regular time-table, and, provided one times one's ascent or descent so as to avoid crossing certain slopes at certain hours, one is absolutely safe. In winter, avalanches can fall at any hour of the day, under certain circumstances, and at any temperature. To take a concrete example: the Gauli hut. This hut lies at the head of a very steep and narrow valley, the Urbachthal. In winter one would never be quite safe in this valley. A sudden wind might rise and bring down a powder avalanche; and even in steady weather the risk of a powder avalanche from the very steep sides of this valley is never entirely absent.

In spring one leaves Meiringen before midnight, climbs this valley at night, and, provided the weather is fine, one is absolutely safe; for in spring, avalanches fall

in the afternoon and never fall at night, save when the Föhn is blowing. And when the Föhn is blowing the ski-runner stays at home, or remains in a club hut.

Finally, the glaciers are not oversafe in winter, for reasons explained on pp. 448–449. In May all save very badly crevassed glaciers can be descended on ski by an unroped party, without greater risks than those which must be faced by every bold pedestrian that crosses Piccadilly Circus. The crevasses are never so securely bridged as in spring.

(2) *Quality of the Ski-ing.*—In winter it is the exception to find good snow in the High Alps. The wind, as has already been explained, spoils the snow on all exposed slopes. But in May the wind is powerless, for the first fine day and hot sun will melt the snow so thoroughly that all traces of wind action during the snowfall will entirely disappear. Thenceforward the wind is powerless, for the wind cannot churn up the heavy melted snow of spring, still less the hard crust which is found in the early morning.

Snow in spring is hard crust in the early morning, Telemark crust up to midday or later on high north slopes. In the afternoon it is usually soft and heavy, but in the evening it once again yields fine ski-ing.

The ski-runner who visits the High Alps in winter can form no forecast as to the possible conditions of the snow, for the snow is dependent on the direction and on the strength of the winds that have blown since the snow fell. It is therefore a matter of chance whether the snow is good or bad, for nobody can foretell the conditions which depend on such a fickle element as the wind. The longer fine weather endures in winter, the greater the chance that the snow will be spoiled. In spring the reverse is the case. *The more often snow is melted and refrozen the better it becomes.* In general, provided the weather remains fine, the spring ski-runner can count almost with certainty on perfect ski-ing and perfect snow.

An important point in favour of spring is the fact that one usually gets good ski-ing for every foot that one climbs on snow. In winter the summit snow slopes are often so windswept, that the ski are left some distance below the actual top and the final ascent is made on foot. In spring the snow is just as good on

the most exposed summit slope as lower down. I have started spring or summer ski descents from the *actual summits* of such peaks as the Dom, Ebnefluh, Galmihorn, etc. This is an important advantage, and more than counterbalances the fact that the snowline is higher in May than in February; for though one may lose a thousand feet of ski-ing on the last day, one more than balances this loss by the fact that good ski-ing is obtained from the highest limit of the snow.

The snowline in May usually extends down to 5000 feet. I have spent three May months in the Alps, and I have always been able to get good ski-ing well on to the middle of May down to about 5500 feet, and sometimes lower. In narrow valleys the remains of spring avalanches survive into the summer. I have skied in the middle of June below 6000 feet in the Gredetschthal, and I have often, in the middle or end of June, obtained first-class ski-ing below 7000 feet.

Of course the height of the snowline is of no very great importance if, as is usually the case, one spends four or five days on the glaciers. One can sacrifice a thousand or two thousand feet of ski-ing on the last day with complete composure if one is certain, as one is never certain in winter, that one will get really good ski-ing for every foot of snow slope that one climbs.

(3) *Effort.* — Much less energy is expended on a spring than on a winter ski tour. In winter most of the climbing is done on ski. Tracks have to be made in the soft snow; a gradual zigzag course has to be taken; time is wasted over 'kick turns.'

In spring one climbs on foot or on crampons. The ski are dragged behind on string. On level or gentle slopes the weight of the ski is almost imperceptible if they are pulled along on string. On steep slopes they are by no means a great hindrance. It is surprising what can be accomplished by a man who is dragging instead of carrying ski. I have seen Knubel climb a short but very steep snow and ice wall in which he had to cut half a dozen handholds, and on which he had to steady himself with one hand while he cut hand and foot holes with the axe held in his right hand. Meanwhile his ski were dangling on string—attached to his waist—over the bergschrund below.

The ski should, of course, always be secured by two strings in case one breaks.

In spring on hard snow one climbs very nearly as fast dragging one's ski as one would climb without ski, and from 50–100 per cent faster than one would climb if one was forced to ascend the same slope on ski with soft winter snow.

The saving of effort is as remarkable as the saving of time, for it is much easier to climb direct on foot than to zigzag up soft snow on ski.

Apart from the upper snows, the approaches to the High Alps are easier in spring than in winter. The snow at night is nearly always hard in May. The narrow valleys, filled with soft powder snow, are covered with a firm groundwork of hard crust in spring. The climb to the club hut is usually done at night or in the early morning. Though the snow lies down to five thousand feet well on into the middle or end of May, so that the ski descent can be prolonged down to very low levels, it is usually possible to pick a route up snow-free slopes (either on southern or south-westerly or south-easterly slopes) far higher than the lowest levels of the snowline. Paths can be utilized instead of snow slopes, more especially if the peasants have begun to tramp out the paths for their own purposes. The long detours, often necessary in winter, to avoid dangerous avalanche slopes are needless in spring, for such slopes can always be crossed with safety at night when the snow is crusted.

(4) *Scenery.*—I have tried to show that the High Alps yield better and safer ski-ing in May than in winter. Even if this were not so, May would possess a charm for the mountaineer that no other month affords. It is perhaps idle to compare the rival beauties of the four great alpine seasons, for, even if one season could be proved paramount, the true mountaineer would wish to study the mountains in all their moods. The icy virginity of the High Alps in winter reveals secrets that are hidden in spring and in summer.

None the less, if it be permitted to state a preference, I for one should give my vote to May months. Contrast is the greater teacher, and May is the month of contrasts. I think of moments when one stepped on to a high ridge after hours among the burning snow-

fields of May, and looked down, with a shock of surprise, on to the valleys dressed in a green that was different, transfigured, miraculous—a green that the valley-dweller has never seen. I think of quiet evenings after long days among the snows, when one strolled down through the scented pines with one's ski on one's back and the music of a perfect run still echoing in one's heart—of the Dollfuss in May, a little oasis of green young turf covered with gentian and anemone in a wilderness of burning snow and granite ridges. I think of a sunset hour just above Rosenlaui, following four perfect days among the May glaciers, the foreground of marsh-marigolds a sheet of flame, and the whole valley one full-throated chorus of spring. Running water is always beautiful, but there is no music in all the harmonies of Nature to compare with mountain torrents in spring after days among the dead silence of the upper snows. Such are the contrasts that reward the mountaineer in May. Within the compass of dawn and sunset he can live through the cycle of the seasons, can pass from winter to spring, can enjoy the best that snow yields to the ski-runner, and the chiefest rewards that the hills yield to those that explore them when the great rebirth of colour and music has finally prevailed over the stubborn obstinacy of the retreating snows.

In order to understand the conditions that prevail in the High Alps in spring, the effect of sun on snow and the various habits of sun-formed and sun-melted crust must be grasped. These are dealt with on pp. 412–417. Avalanches are analysed on pp. 423–438. All that now remains is to consider the application of the principles laid down to the various months of spring.

March.

The winter of the calendar ends officially on 23 March, and the calendar spring lasts from 24 March to 23 June. None the less March, whatever the calendar may say, is winter in the High Alps. The snow, unless disturbed by wind, remains powdery on all north slopes and gentle south slopes. March is often a month of snowstorms, though occasionally it is distinguished by really fine weather. On the whole, however, it cannot be said to be a good month for glacier ski-ing, though, on the other

hand, the days are longer than in February. The sun is stronger and the crevasses more securely bridged.

April marks the transition from winter to spring. As a rule, April is marked in the Alps by frequent storms, varied by periods of wet Föhn. Occasionally one gets a week of really good weather and fine ski-ing, even at very low altitudes, and it often happens that the last week in April is perfect succeeding to a long period of snowstorms. But as a rule good weather is less common in April than in any month of the alpine year.

April.

The snow itself varies. Powder snow is found on north slopes at high altitudes. South slopes are usually crusted. The crust varies a great deal, and resembles, in general, the crust found in winter at low altitudes. In other words, April crust on the glaciers is usually marble crust in the early mornings. The law, explained on p. 414, "The milder the frost the better the crust," often gives the clue to timing a successful descent. As one descends on an early morning in April the crust usually improves.

As a rule, the sun is strong enough to melt the crust just before or just after midday, and in this case you get perfect running on Telemark crust. Owing to the lower temperature the snow remains good much longer than in May. In fact, at high altitudes it seldom becomes completely thawed, so that the ski-ing on April afternoons is usually better than on May afternoons.

It is important to notice that when, as in spring and summer, the sun remains above the horizon after 6 p.m., the northern slopes will be in the sun after the southern slopes have lost the sun, for the sun at 6 p.m. is due west and after 6 p.m. is north of west. Of course, as the sun is low in the sky only north slopes that are not shut in by neighbouring slopes will keep the sun.

If a north wind is blowing, the snow on north slopes, previously crusted by sun and frost, may remain quite unmelted throughout the day. I have found hard slippery crust in the late afternoon at the end of April just below the rocks of the Zinal Rothhorn, with the result that the ski-ing was most unpleasant. A bitter north wind was blowing at the time. So, too, south slopes when the north wind is blowing may resist the

sun, and though they will not, like north slopes, remain really hard, they will not be thoroughly melted.

If you are lucky enough to get fine weather, April ski-ing is often delightful. After a few days of sun traces of wind action disappear from all slopes, save perhaps north slopes at very high altitudes. Telemark crust towards midday, and even later, and salt snow or hypo snow (p. 417) as you descend from the glaciers to the lower regions, are characteristic of April ski-ing.

It may be necessary to time your descent to the valley so as to pass a dangerous slope before the sun has struck it. With ordinary caution an experienced party should run no risk whatever of being caught by an avalanche; but it is undeniable that inexperienced parties come to grief more frequently in April than in any other month. This does not prove that the avalanche danger is really greater, but only that it is greater for the inexperienced.

May. In May newly fallen snow usually remains powdery for one or two days on north slopes, and even longer at high altitudes. But, in general, powder snow is the exception in May. At high altitudes you will find hard marble crust in the early morning. At lower altitudes you will usually find 'film crust' and 'perforated crust.' For the formation of these excellent running surfaces, see p. 414.

The main difference between marble crust on the one hand, and either film crust or perforated crust on the other hand, is that the former is too slippery to give the ski purchase, whereas film or perforated crust is a splendid surface for Stemming turns or Christianias.

As a rule, in spring one descends after the sun has softened the crust. Whether the original morning crust was hard and slippery, or covered by a film or perforated crust, does not matter once the sun has melted its surface.[1] In any case, there will be a period of ski-ing on Telemark crust (p. 415). The main importance of film or perforated crust is its value when you have to begin a descent before the sun has softened the snow. I remember starting one morning just after the dawn from the Oberaarjoch. I intended to ski down to the

[1] Provided that the night has been cloudless. An overcast sky, or Föhn, will only produce a very weak crust which gives at once when the sun rises. See footnote on p. 415. A couple of hours of a cloudless sky is, however, quite enough to produce a good firm crust at night.

Grimsel and thence to climb the Galenstock, and I hoped to go from the Oberaarjoch hut to the Furka between dawn and sunset, taking the Galenstock *en route*. It was obvious that an early start was necessary. At that date I had done little ski-ing in June, and I fully expected that the top slopes of the Oberaarjoch would be covered by very hard and slippery marble crust. To my great surprise the crust, though hard, was covered by a beautiful film of soft, transparent brittle ice. As the ski swung round on a turn, this soft film peeled away and rustled down the slope with a soft splashing sound. No surface could be finer. Straight running was absolutely safe on the even, unchanging gradients of those summit slopes. There were no hidden rocks or hidden crevasses to fear. The film crust was absolutely true. There was no risk of running into a soft sticky patch or a windswept pocket. One could run as fast as one liked, secure in the knowledge that at any moment one could stop by a long-drawn-out Christiania. On really steep slopes one could link a succession of sweeping Christianias, the loveliest of all conceivable turns, and on gentle slopes one could run straight. The soft film gave an excellent purchase and prevented the ski side-slipping helplessly as one began to turn, for the ski cut in under the film and peeled it away.

Until a man has skied down from some glacier pass at dawn on film crust he has yet to learn the best that ski-ing can yield. That run from the Oberaarjoch stands out as one of the finest runs of my life. The great charm of film crust is that fast running can be combined with absolute safety, for a dangerous fall is almost impossible on this surface. I remember that we took twenty minutes from the pass to the snout of the glacier, and duly arrived at Gletsch after taking the Galenstock *en route* before sunset.

Perforated crust is harder and firmer than film crust. On very steep slopes it is a little too slippery, but on anything below 25 degrees it gives perfect running.

In May film crust and perforated crust are common in the early morning, and marble crust is unusual. After fresh snow one finds all sorts of shades of snow from pure winter snow to film crust, but a few days of cloudless weather is usually sufficient to change powder into crust on all but very high north slopes.

June differs mainly from May in that the snowline is higher and that winter snow is even more uncommon.

June. Film crust and perforated crust is the rule at all save high altitudes and just after fresh snow.

As a rule the snow is even better in June than in May. *The more frequently spring snow is melted and refrozen the better it becomes. Old snow that has passed through this process again and again acquires a granular and crystalline character.* It does not melt so thoroughly. Provided there is no touch of Föhn in the air, it retains this crystalline form even when it is melted. In June the snow remains good for ski-ing much later in the day than in May, even though the sun is higher in the sky. In May the period of transition from wet snow to crust is very sudden. One moment the snow is wet and heavy, and half an hour later the first crust has formed. In June there is often a well-marked intermediate period when the snow gradually gets colder and more crystalline. This granular snow is very fast and very true, and suitable for every kind of turn and swing at high speed. On May evenings the soft crust is very pleasant, but it is a little too soft and the snow underneath the crust is a little too woolly ; but in June when the sun goes off the slopes the snow becomes crystalline, cold, fast and just compact enough to prevent the ski sinking in too deep.

In June the lower limits of the *névé* often show signs of furrowing. The action of the sun forms ridges and furrows producing a wavy effect. These ridges are unpleasant to ski on or to ski over when the snow is hard, but quite harmless when the snow has begun to soften. On steep slopes the ridges run roughly parallel with the fall of the slope. On the level the snow is divided into numberless little hillocks with corresponding holes.

The action is similar on a small scale to the erosive action of water on a large scale. Water furrows an even mountain side with gullies and a more or less level plain with intersecting ravines that produce a series of hills. And just as in the geological cycle the last stage of a mountainous country is a peneplane, so on snow the action of the sun acts on the ridges and hillocks formed by previous action of the sun and once again reduces the surface to a plain. I have seen in winter one heavy

rainstorm furrow the hillsides with miniature ridges and a level snow slope with miniature hillocks, and I have seen the next rainstorm—which followed two days later—erode the ridges and hillocks formed by the first storm and once again produce slopes of even contour and levels unbroken by hillocks.

The Spring Time-table

The spring ski-runner has, in general, the choice of two periods of the day for his descent. He can descend in the morning just after the sun has begun to soften the surface of the hard crust, or in the evening when the soft melted snow is beginning to freeze again. If the day's run ends at some club hut situated at a reasonable height, say 9000–10,000 feet, he can usually leave the hut about dawn and return about midday, for the snow at this height is usually perfect just before midday; or he can time his descent for just before or just after sunset. If he is descending to the valley, it is usually best to time his descent a great deal earlier. In May the snow below 8000 feet softens very quickly directly the sun touches it, and becomes dangerous on steep slopes. In this case, should the snow on the glaciers be film or perforated crust, he can start his descent before the sun has softened the crust, so as to reach the lowest limits of the snow before they have been softened by the sun.

As this is often impossible, it is best to time the descent from the peak to the club hut for midday, or rather before midday, and then to wait in the hut till sunset, and continue the run down to the valley after the sun has set and the snow begun to freeze again. Guides are often dreadfully impatient, and have the greatest objection to spending a long time on the summit of a peak. Many guides seem to regard summit views with studied malevolence, and very few guides really understand spring snow. If, as often happens, the arrival on the summit occurs after midday, it is absurd to spoil a perfect descent by running down in the afternoon. The amateur must exercise reasonable restraint and insist on waiting. There are many things more unpleasant than to lie about on the summit of some great peak for three or four hours studying the changing

effect of a May afternoon on distant hills and valleys, what time the snow gradually improves.

Great judgment is required in spring to get the best value out of the descent; it will often pay a party to wait three or four hours for the snow to improve. Summer climbers seldom linger on the summit, for in summer the wind usually makes itself felt, but in May or June one can bask on the top of a peak in shirt sleeves even after the sun has set.

Eastern slopes, of course, are the first to soften in the morning and the first to freeze at night. The best moment to descend varies with the orientation of a slope. It is often possible to choose one of two alternatives,—an eastern or a western route,—and the wise ski-runner can often improve the quality of the descent by a clever choice of line and slope.

Considerable experience is needed after a fresh fall of snow. Snow usually remains powdery for a day or two on north slopes in May or June. Perfect powder snow is by no means the exception in spring; an inch or two of winter powder on spring crust provides a surface which is absolutely unrivalled. When, however, the powder begins to turn into crust the ski-ing may often be difficult. After a snowfall you should try either to find slopes holding winter snow or slopes holding spring snow, but not slopes on which the snow is just changing from powder to crust. You may, for instance, have spent the night at a club hut at a height of 9000 feet above the sea. You have arrived in the middle of June on the first fine day after a snowstorm. The snow near the hut has been thoroughly melted by the sun before your arrival. The weather is clear, and there is a north wind blowing. You may reasonably expect powder snow on north slopes down to about 10,000 feet, so that if you have a choice of an expedition on north snow, say a peak 13,000 feet high, you should attempt it, and you will probably find powder snow most of the way. On the other hand, a peak of the same height that faced south might be an unpleasant condition, powder turning into sticky snow or crust. It might therefore be best to choose a small peak, say 11,000 feet, facing south, and run down below the hut, remounting in the evening. Such an expedition might yield better ski-ing than a high peak.

After a day or two of fine weather all snow, excepting snow on north slopes at a very great height, is transformed into ordinary spring snow. Thenceforward the ski-runner may count on perfect snow, provided he times his descent right.

It is only with forty-eight hours of a snowfall that there is any real difficulty. During such short periods the experienced spring ski-runner will know whether to go for north slopes in the hope of winter snow or for southern slopes, or north slopes at lower altitudes, in search of spring snow.

Summer and Autumn Ski-ing

In summer the snowline climbs ever higher, and the scope of the ski-runner is accordingly limited. Climbers who go straight up a peak and down again to the valley will therefore be unwilling to burden themselves with ski ; but for a man who spends several days in club huts without ever descending far below the summer snowline, the use of ski for snow-peaks is as valuable as at any other season of the year. Monte Rosa, Ebnefluh, Fiescherhorn, etc., yield quite as good ski-ing down to the club-hut levels in August as in January—better, in fact, for the snow is usually better in August than in January.

Of course the crevasses are more open than in spring, and the greatest care is needed after a fresh fall of snow.

The snow conditions as the summer advances gradually change. July is not unlike June, excepting that there is less snow on the mountains and that the snowline is higher. Otherwise one finds in July all the varieties of spring snow from film crust to granular snow.

On 20 August the sun is at the same altitude as on 20 April, and on 20 September it is at the same altitude as on 20 March. So that towards the end of September we should expect that the sun would be powerless to affect powder snow on north slopes just as it is powerless at the end of March to transform powder into crust on north slopes at reasonably high altitudes.

In August powder snow on north slopes usually remains uncrusted for two or three days after a fall. The wind, which was powerless in May or June, begins to

regain its ascendancy. In August one finds at high altitudes on north slopes all the usual effects of wind action that one may observe in April. One does not see the same traces of wind that one observes in January, for the snowfalls are lighter and the sun is stronger, but windboard and rippled snow are common enough in August.

In September and October snow remains powdery unless affected by Föhn on north slopes above 9000 feet.

In October the snowfalls usually begin at the ordinary alpine centres. I have enjoyed perfect ski-ing at Mürren by the middle of October ; ski expeditions in the High Alps have also been carried out at this date, though the practice is to be discouraged; for, of course, the glaciers are never so dangerous as in October or November, when the maximum number of crevasses are open and the snow bridges more insecure than at any other period of the year.

In a few years' time many club huts will be provided with ski, so that the trouble of carrying ski to the summer snowline will no longer exist. When once this obstacle to summer ski-ing is removed, I confidently expect that it will be the exception rather than the rule to see climbers ascending Monte Rosa or similar peaks without ski at any period of the year.

Summer Ski

Short summer ski are very useful. A handy size is about 5½ feet in length. Such ski are very light and easily carried, and can be tied on between the rucksack and the back. They are becoming very popular, and have a great future.

On hard snow short ski are nearly as fast and as steady as long ski. On soft snow they are, of course, nothing like so fast, and are apt to be jerky and unpleasant if the snow varies in density or in speed. On steep slopes of soft snow they are quite as good as long ski, for they are very easy to turn; and so long as the slope is steep enough to descend with continuous turns, short ski are as good or better than long ski. It is on gradual slopes of soft snow or crust that their disadvantage is marked.

They are amazingly handy for really steep narrow slopes, such as gullies. On short summer ski one can

descend a gully 40 degrees steep and about 12 feet wide with sharp continuous turns. Stemming turns and Christianias are ridiculously easy.

Mountaineers who have never been on ski will find short ski quite easy to manage. A man who can glissade with safety down a steep gully will be able to ski almost at once on good snow and on easy slopes without too many falls, and should be able to make slow turns on short ski after a day or two's practice. Provided the snow is good, the average *névé* is an ideal practice-ground for beginners owing to the absence of obstacles.

Even very short ski, 3 feet or 4 feet in length, are a great deal better than no ski. On steep slopes they are most useful, and even on gentle slopes, provided the snow is hard, one can get a really fine run on a pair of ski no more than a yard in length.

CHAPTER X

MOUNTAIN PHOTOGRAPHY

BY SYDNEY SPENCER

IT is somewhat superfluous to draw attention to the immense popularity attained by photography in the mountains. Among climbers very few are content to supply their requirements from the work of others, and it may safely be asserted that a camera is almost certain of its place in the outfit of at least three-fourths of the climbing parties of the present day. It is true that the majority of these confine themselves to snapshot photography. This cannot be regarded as a serious form of the art, seeing that it is practically impossible to compose a picture on the diminutive scale of the usual view-finder, and that the films generally used are too uncertain in results. Photographers, also, of this class very rarely trouble to do their own developing.

Excellent work can, however, be done with a hand camera. It has one drawback: the lens is usually a fixture, and provides only one fixed focus, a very important consideration in serious photography. But if the climber decides to use such a hand camera, the following remarks may be of service.

The best form for mountain work is the folding variety. There are innumerable good makes from which to choose.

The Camera. Reflex cameras are too bulky for mountain work. The adjustments should be as simple as possible; and for good work a focussing glass is essential. The lens, by far the most important portion of the camera, should be the very best obtainable. It should be fitted with automatic shutter for instantaneous and time exposures, and also with a lens cap. This latter I have always preferred to use for long exposures in preference to an automatic shutter. It is much easier to avoid

shaking the camera in removing a lens cap than it is in pressing the lever of an automatic shutter. The use of a wooden folding tripod with a triangle top I strongly recommend in preference to the brass or aluminium tripod with telescoping legs, since such legs are not sufficiently rigid. I advocate the use of glass plates; and three dark slides, or better still, a changing box to hold six plates or twelve cut films, complete the apparatus. So far, the most satisfactory changing box I have come across is one 'made in Germany'; of which the description is given on another page of this chapter. An adapter for a film-pack adds very little to the weight, and is a useful addition to the outfit. A hand camera such as I have described is of great service on rock climbs of difficulty, where it is not expedient to embarrass the party by taking the more complicated paraphernalia of a stand camera.

There is a type of climber to whom the merely gymnastic or, we will say, athletic side of climbing is not the sole aim and object of the sport. He is an enthusiastic lover of the marvellous beauties of the mountain recesses, and wishes to take home impressions of the peaks and glaciers as he himself has seen them; for climbers know well that the mountains are ever changing in aspect from one year to another, or even from season to season. He sees and desires to record atmospheric effects which may never be repeated during his climbing experience. He takes his photography seriously, and he is consequently prepared to put himself to a considerable amount of trouble to obtain really artistic records of the scenery amongst which he climbs.

For such a type of climber I decidedly recommend the stand camera in preference to the hand camera. It entails rather more trouble, but this is certain to be justified by the superior results.

The component parts of a stand camera outfit may be enumerated shortly as follows:

1. *Body of the Camera.*—This should be of the best possible make, with metal-bound corners, and fitted with a metal turn-table. All the metal parts should be of aluminium, for the sake of lightness. It should have the usual rising front and swing-back, and an adjustable focussing glass for horizontal or vertical pictures. The body must, of course, fold up, and it is most important

that all the adjustments should be as simple as possible, so as not to waste valuable time in a climbing day.

2. *The Lens.*—This, as I have already remarked, is the most vital feature of a camera. For stand camera work I would urge the adoption of a set of three or four interchangeable lenses, as this gives the photographer a wide range of focal angles to choose from, and practically enables him to include in his pictures just as much as he desires. For a half-plate camera, two 14-inch, one 11½-inch and one 9-inch lens make a good set, giving a series of focal lengths ranging from 5¾ inches to 14 inches. For a quarter-plate camera, two 11½-inch, one 9-inch and one 7¼-inch lens will give a range of focal lengths from 4⅛ inches to 11½ inches. The lens mount is fitted with an iris diaphragm and a detachable ring marked with the apertures suitable for each lens combination. A yellow screen, of such a shade as to increase the exposure by three times, is useful where there are trees or grass in the foreground, and serves also to soften the shadows. Its use ensures clouds not being lost in development through over-exposure, although it cannot be claimed that successful results may not be obtained without it. It is also of distinct advantage in a hazy atmosphere. A Thornton Pickard shutter will be found useful, but for time exposures the lens cap is really all that is necessary.

3. Three ordinary double-back slides are usually taken ; but they may be replaced by a changing box—a more convenient and compact way of carrying the plates. Most of the changing boxes on the market are made with a folding leather bag at one end, and the changing of the plates from front to back is effected by hand; but the writer has always used a changing box in which an inner shell pulls out like a drawer, taking with it, by means of a clip, the exposed plate in its sheath. As soon as the inner shell is drawn out to its full length the sheath drops to the bottom of the shell. This is then pushed back again, and the used plate slides in at the back of the unexposed plates, which have meanwhile been pushed up by a spring. The metal sheaths are numbered on the back. The photographer can see which number has been taken by turning over the box when he has partly pushed back the inner shell after the exposed plate has dropped to the bottom. He will then see the

number through a red glass-covered opening. As this appears to be the only box of the kind which is made, it may be advisable to state that it is known as the 'Grundmann' changing box. Some enterprising British firm should be induced to bring out something similar. The movements are so simple that it can hardly fail to work properly.

Six plates are generally sufficient for one day's work, and a changing box made for that number will not weigh more than three dark slides with the same number of plates. If desired, the six plates can be replaced by twelve cut films in suitable thin sheaths.

4. *The Tripod.*—The ordinary camera legs on the market are, even when folded, inconveniently long for mountain work, and for rock climbing may prove a real source of danger. For comfort, legs when folded should not measure more than 12 inches at the utmost. It is best to have a set specially made, and I know of nothing better than a set made in the following manner. The bottom section of each leg is a solid square-sided aluminium bar with a very sharp point. This slides into a square wooden frame. Over the frame the two next sections are folded; the top one folds inside the second, so as to unfold in the same direction. Made in this way, the tops need only to be pressed together in order to fit them, with a slight spring, on to the pegs of the turn-table. A cross strut makes the fit tight and immovable. The total length of the legs opened out is about 42 inches, which is quite as long as is necessary for mountain work. A set of legs made in this way stands perfectly rigid; it will also go easily into the side pocket of the rucksack, or it can be carried on the top of the sack without the slightest inconvenience to the climber.

5. The outfit is completed by a focussing cloth, with a running tape along one side, which prevents the cloth from blowing about in the wind.

As regards the comparative merits of glass plates and films, the latter have the one great advantage of lightness, but they are notoriously uncertain and much more difficult to control in development. The most satisfactory results are obtained with slow plates, of which six are enough for any ordinary expedition.

It is not a bad plan to take in addition an adapter with a film-pack, for snapshots of climbing incidents.

The best size of camera to take is a debatable point. Half plate is the largest which can be carried with convenience; and for the best results there is no question whatever that the larger size is the better to work with. A half-plate camera, as described, can be carried on most ascents of average difficulty; with the possible exception, perhaps, of strenuous rock climbs, such as the Dru or the Grépon, where anything but a hand camera is liable to be a distinct incumbrance.

But on the whole, for all-round utility I am inclined to recommend the quarter-plate size. In addition to the economy in weight and bulk of the whole apparatus, the quarter-plate negatives are a more convenient size from which to make lantern slides, and excellent enlargements can always be made from good negatives of this dimension.

The Choice of Subject.

We come now to the all-important question of choice of subject; one on which it is most difficult to give definite advice, seeing that so much depends on the artistic perceptions of the photographer. Photography to a certain extent is a mechanical art, but good photographers invest their work with a decided individuality; and it is this at which the novice should aim.

The first thing to bear in mind is the proper balance of proportions. To achieve this the set of interchangeable lenses already recommended are indispensable. Without them a photographer must find considerable difficulty in conveying the true impressions of the mountain landscape as seen from the point at which the photograph is taken.

Panoramic views of distant ranges will of course always continue to be taken; but as pictures they are of small value unless they are assisted by atmospheric effects of cloud or mist.

In photographing peaks close at hand, it is usually best not to include more than one summit in the picture, or at any rate to make one peak the central point of interest. Others may only be included if they can be made to enhance the value of the main feature in the composition. The majority of views of this type look best if they are taken on plates placed vertically; but this is by no means a rule to be rigidly followed. Broad mountain masses, such as Mont

Blanc and the Grandes Jorasses, or composite peaks, of the type of Monte Rosa, should always be taken horizontally.

The chief feature in the picture should never be placed in the centre, but rather to one side of the view; and the lines of intervening ridges and glaciers should be included, so as to lead the eye towards the main object. This produces the necessary impression of distance and depth; an easy effect generally, if the photo is taken from below, but not always feasible if the view is from a summit. The effect of distance and depth is always much helped by a good foreground, but the foreground must not on any account draw the attention from the main feature.

Such a foreground is of special value in the case of views of peaks as seen from a summit, where it is not possible to include the base of the peaks in the picture. A few rocks intruding in the immediate foreground, or a ridge running so as to connect the distant view with the standpoint of the photographer, removes the feeling of blankness and of lack of distance which the absence of any foreground is apt to produce.

The amount of sky which may be properly included should occupy from about a quarter to a third of the plate. Too much sky produces a very bad effect; whilst, on the other hand, many photographers make the mistake of bringing the peaks too near the top of the picture, giving them an unnaturally attenuated appearance.

Ice-falls and much-broken glaciers compose very easily. On the other hand, broad expanses of snowfield are about the most difficult subject the mountain photographer can tackle. The texture of the snow is the one thing to aim at. If this is not brought out, the picture is valueless. Slight under-exposure is the secret of success. For these subjects it is better to have the sun well in front, as the light on the snowy surface is then well broken by shadows.

For the other kinds of mountain subjects I should recommend the novice, where slow plates are used, to err on the side of over-exposure, and to develop slowly. By this method he will find it is easier to get atmosphere into his pictures. A certain amount of detail may be lost in the distant objects, but he will secure a much truer gradation between his distances.

As regards the development of slow plates, it should be noted that this can be carried out with comparative strong light, provided it is suitably shaded. The developer should be gradually increased in strength. The photographer can then see easily what he is doing, and, by means of brushwork, can control the development of any portion of the negative.

Broken light is essential to the success of most mountain photographs, and for this reason the best time for taking them is usually early and late in the day. This is of course not an invariable rule, and the photographer must be guided by the subject he has in front of him. Moreover, the climber is not always able to choose the time of day for his work. If the midday light is very brilliant, the yellow screen can be utilized. Personally, I have used it very seldom, but have made a practice of using a very small stop, and have trusted to slow development for the rest.

I should like also to draw attention to two other forms of photography which have been introduced in recent years, and have proved very attractive to climbers. Colour photography exercises an extraordinary fascination, and it would doubtless become still more popular if the plates were less costly. There are several forms of plates and processes, and with all of them some remarkable results have been obtained. The different processes vary somewhat in simplicity of manipulation. One of the simplest is the Lumière Autochrome. The photograph is taken in the ordinary way, but with the proper light filter, as prescribed, fixed on the lens front. It is to be remembered that the focussing glass must be reversed owing to the fact that the plate is placed in the dark slide with the film turned inside. The essential point is to learn to judge of the correct exposure. Over-exposure can be corrected by intensification, but it is a troublesome process. The development is perfectly simple if the instructions given are carefully followed. It is very important to see that the solutions used are cold enough, otherwise the unhappy photographer runs the risk of watching a perfectly successful colour picture melt away in front of his eyes.

Colour Photography.

The other form referred to is stereoscopic photography, which is more particularly adapted to snap-

shots of climbing incidents and to studies of rock and glacier scenery near at hand, since the pictures can be taken with the camera held at any angle, even pointing directly above the head or below the feet, and the scenes are afterwards reproduced in marvellously lifelike manner in the stereoscope. To secure the full stereoscopic effect the 'lines' of the picture should start from the immediate foreground and carry the eye away to the main object, i.e. the camera should be held close down to the surface of water or glacier, or with one side close against a wall of rock as foreground. A rock crest running immediately away from the camera, or two, containing walls of ice or rock on either hand, give the best results, and provide the framework of illusion for the more distant scene. The stereoscopic effect is lost in distant views. The handiest size in this camera, the 'Veroscope,' is 107 cm. by 45 cm. It is made of metal throughout. It carries a detachable magazine of twelve plates, and weighs rather more than a pair of field-glasses. Films can be substituted for plates for lightness, but the results are on the whole inferior. If it is carried in a strong leather case, the camera will stand an extraordinary amount of rough treatment on rocks and immersion in rivers. It is especially suited for difficult climbing and exploration, where it is desired to record special passages and incidents, at angles, and in circumstances and climates, in which the ordinary camera is useless.

Stereoscopic Photography.

My final piece of advice is, never leave the camera behind, and never waste plates or time unless the result is likely to be successful.

CHAPTER XI

MOUNTAINEERING IN TROPICAL COUNTRIES

BY A. F. R. WOLLASTON

(The suggestions contained in this chapter are based on some experience of travel in the mountains of Africa and New Guinea, and it is assumed that the conditions are not materially different in the mountains of tropical South America. It is taken for granted that the transport animal is man, and that after entering the mountains the traveller must depend entirely on the provisions he carries with him. The medical suggestions are intended only for those who have no special knowledge of the subject, and for conditions in which only the simplest treatment is possible.)

Health

THE first essential to the success of an expedition lies in the good health of the various members of the party. Hard work in the trying conditions of tropical mountains soon saps the energy of the most robust, but by taking proper precautions a man may continue in good health for six months or even longer.

Prevention of Sickness.

When the body is for many hours daily bathed in sweat and smeared with mud, personal cleanliness becomes of the first importance. A bath, if it can be managed, or a sponge-down, should be the rule every evening, and all cuts and scratches must be carefully attended to and protected from infection. The question of hot or cold water may be left to the preference of the individual, with this reservation, that no man should ever take a cold bath when he has cooled down after freely perspiring.

The teeth are liable in hot climates to become loose and even to fall out. They should be kept scrupulously

clean, and the mouth may be washed out with a weak solution of Condy's fluid. The hair should at all times be cropped short both for comfort and cleanliness, and paraffin or some other oil should be rubbed into the scalp.

A regular action of the bowels is even more necessary in tropical than in temperate climates. There may be some difficulty about this on a diet of tinned foods, but it can generally be ensured by a daily plate of porridge (see below, Constipation). To avoid malaria every effort must be made to escape the attacks of the *anopheles* mosquito. It will not be possible for the traveller to carry with him a mosquito-proof tent, but failing this, he must use a well-constructed mosquito net, made in one piece, without an opening at the side. The lower edge of the net should not hang loosely, but should be tucked under the edge of the mattress if one be used, or otherwise stretched tightly round the edge of the bed. The meshes of the muslin should not be less than twelve to the inch. It is good economy, as well as being more humane, to provide your 'boys' and other servants with mosquito nets. Mosquito boots, i.e. light boots with long loose uppers of canvas or thin leather, into which the trousers can be tucked, are conveniently worn in the evening to prevent mosquitoes biting the ankles. If a camp be occupied for several days, it is advisable to see that stagnant pools near by are filled up, and that no discarded tins are lying about to become filled with rain-water, in which mosquitoes may breed.

Here it may be convenient to state that very many diseases of the Tropics—cholera, dysentery, typhoid, bilharzia, etc.—are spread chiefly by means of water. It is therefore of the greatest importance to make sure of a supply of pure water. Filters will remove mud and other suspended matter from water, and a good filter in perfect condition *may* provide a sterile water; but it is seldom possible to keep a filter perfectly clean, and it is better to do without it altogether. If the water is stagnant, or if there is any possibility of its having been contaminated in any way, it is always advisable to boil it and make tea, or if it is preferred, to aerate it with sparklets. "When in doubt, boil," is a golden rule.

As a medicinal prevention of malaria there is nothing more effectual than to take a daily dose of 5 grains of quinine bihydrochloride. As this is a somewhat ex-

pensive drug, the native members of the expedition, if they are numerous, may be given the less costly (but less soluble) quinine bisulphate, 5 grains. If it is not convenient to give quinine to the natives every day, it may be given to them in 10-grain doses twice a week on consecutive days. The tabloids may be sugar-coated for the natives, who may otherwise surreptitiously reject them.

(*The following suggestions are intended for the necessarily limited possibilities of a mountain camp.*)

Malaria.—So long as his temperature is above normal, the sick man should, if possible, be kept in bed. Give 3 grains of calomel followed by a dose of Epsom salts to clear the liver and bowels. Continue to give three doses of 5 grains each of quinine bihydrochloride every day that the fever lasts; but do not give the quinine while the temperature is raised. When the attack has ceased give 10 grains daily for a week, and afterwards continue with the regular daily dose of 5 grains. At the same time it is very important to make sure of a regular action of the bowels. If, while the attack lasts, headache is very severe and persistent, 5 or 10 grains of phenacetin may be given; but this drug is greatly abused and is often of little or no use. Sweating may be stimulated by giving copious draughts of hot tea; when the sweating stage is at an end, the pyjamas should be immediately changed.

Treatment.

Diarrhœa is a very common trouble, particularly when no fresh food is obtainable. It is usually sufficient to take a dose of castor oil and to eat as little as possible for 24 hours. If this treatment is not effective, give 10 grains of bismuth subnitrate three times daily, and a diet of milk and arrowroot or Horlick's malted milk. If the diarrhœa ceases, but there is still discomfort in the bowels, 10 drops of chlorodyne may be given, but in most cases it is better to avoid the use of this drug.

Dysentery.—Rest in bed, warmth, a diet of milk and water and arrowroot, and a preliminary dose of castor oil are the first essentials of the treatment. Severe cases may be well treated by the use of emetine hydrochloride, in keratin-coated cachets, containing one $\frac{1}{2}$-grain dose. One dose should be taken each day, and the treatment should be continued until he has taken altogether 8 grains. As an after-treatment it may be good practice

to take 2 drams of liquid paraffin every night. There are some who advocate the regular use of this every day as a preventative of intestinal disease, but such a thing will be hardly practicable on a mountain expedition with limited transport. The treatment by ipecacuanha cannot be recommended for camp use. Less severe types of dysentery may be treated by giving small doses (1 dram) of sulphate of magnesia every two or three hours to ensure a free watery purgation, which may be continued until the pain has ceased. If the disease proves to be intractable, the sick man should be removed to the nearest place of civilization as soon as possible.

Constipation is not a very common trouble in tropical mountain expeditions. It may generally be avoided by eating a daily plate of porridge and, if they can be carried, by eating prunes and figs. If the camp arrangements make bread-making possible, it is a good plan to mix with the white flour some whole meal, or, in countries where it is grown, the meal made from millet. If none of these measures ensures a daily action of the bowels, a dose of sulphate of magnesia ($\frac{1}{2}$ to 1 ounce) may be taken early in the morning, or one 'Livingstone Rouser' or cascara sagrada or two vegetable laxatives (Burroughs & Wellcome) may be taken over-night.

Sunstroke is not at all likely to occur, but if a serious case should happen, and the temperature rise to 105 or 106, the patient should be stripped and wrapped in cold wet blankets until the temperature falls to 103, after which he should be placed in bed in the darkest and coolest place possible; the bowels must be kept open and a liquid diet given for some days.

Coughs and *Colds* are sometimes exceedingly troublesome. They may often be cured at the outset by taking a hot bath (if that be practicable) with mustard in it, followed by bed with many blankets and a dose (10 to 15 grains) of Dover's powder. A sore throat may be treated by frequent gargles of weak solution of potassium permanganate (Condy's fluid) and by sucking tabloids of chlorate of potash. Nasal catarrh may sometimes be cured by sniffing the vapour arising from the open mouth of a bottle of formalin.

Toothache is one of the most frequent and most distressing troubles of a mountain expedition, and it ought, as far as possible, to be avoided by visiting a dentist

before leaving civilization. If the pain is in a decayed tooth, it is sometimes sufficient, after clearing away the debris, to put into the cavity some powdered carbonate of soda ; it is more efficacious to put in very carefully a small drop of pure carbolic acid on a plug of cotton wool. Pain at the root of a tooth may be relieved by painting the gum with tincture of iodine, but the cheek should be held away from the jaw until the tincture has dried. Some forms of toothache can only be treated by extraction, and no expedition ought to make a long journey without three or four forceps. The sufferer will probably prefer extraction at the hands of an amateur to the horrors of prolonged toothache.

Sleeplessness is often a very serious trouble, not less at high altitudes than in the sweltering heat of the foothills. Sleep may sometimes be induced by drinking a cup of hot cocoa shortly before going to bed; it is also a good plan to have biscuits within reach during the night. If the insomnia is very persistent, it may become necessary to give up smoking and to reduce as far as possible the consumption of tea. The use of powerful sleeping-draughts is strongly to be deprecated, except in extreme cases.

Conjunctivitis is certain to occur to one or more members of the expedition. It is easily treated by a weak solution of boric acid, or an astringent solution of zinc sulphate (1 grain in 1 ounce of water). An eye-bath is easily carried, and is very useful.

Skin Diseases.—The most common that is likely to be met with is ' prickly heat,' which is due to extensive sweating. The amount of fluids drunk should be cut down as much as possible, and some relief may be obtained by the use of a weak solution of carbolic acid (1 in 50). It is a good plan to use a dusting powder before going to bed.

' *Scrub Itch* ' and '*Dhobie Itch*' are names given to a very irritating and inflamed condition of the skin, more especially of the moister parts, such as the arm-pits and the inside of the thighs. It is in many cases particularly troublesome at night, and it is not at all easy to cure. The part should be kept scrupulously clean, and a sulphur ointment (10 per cent) may be applied. A dusting powder of zinc and boric acid often gives temporary relief from the irritation.

Ringworm of one kind or another is almost certain to occur among a large number of men. It is hopeless to expect to cure a case during the course of an expedition, but the spread of it may be checked by the use of a sulphur ointment or by painting the part with liniment of iodine.

Body Parasites.—In places where ' jiggers ' are found, it is certain that the men are adepts at their extraction ; but a European, who takes proper care of his feet and wears long boots in camp, need not be troubled by them. If the body is invaded by lice, they can be got rid of by the use of a mercury ointment.

Snake Bite requires the most prompt treatment. Without loss of time a strong ligature must be tied about the limb above the bite : thus, for a bite on the finger the ligature may be at the base of the fingers, for a bite on the hand or forearm it must be above the elbow, and for a bite on the foot or leg the ligature must be above the knee. The ligature must be twisted tightly by means of a stick, and at intervals of about half an hour it should be relaxed for a few seconds to prevent the risk of gangrene. With a sharp knife the whole of the area about the puncture should be freely cut away, and the wound should be washed with a strong solution of permanganate of potash. A less heroic, but less reliable, treatment is to make two or three incisions into the flesh about the puncture, and to rub into the cuts crystals of permanganate of potash. A small quantity of alcohol may be given, and the patient may be put to bed and kept warm. The popular remedies of large quantities of brandy, walking about, and sucking the wound are of no value.

Leeches, by reason of their delicate gait, often find their way into the most intimate and unexpected places, and may be gorged with blood before they are detected. They should never be pulled off : a touch with the juice out of a well-smoked pipe will cause them to shrivel and drop off. In the early mornings, when leeches stretch themselves expectant on every twig, a wise man will walk in the rear of his caravan.

Cuts and *Scratches,* if not attended to at once, may lead to abscesses and ' veldt-sores ' and an infinity of trouble. Even the smallest scratch should be treated at once with the iodine bottle, which may be easily carried in a pocket, or if necessary, with a bandage.

Boils are best treated by dusting with boric acid

powder and protecting them with a gauze dressing. When they come to a head, the top may be cut off and a drop of pure carbolic acid applied, after which a gauze dressing must be used until it is completely healed.

Abscesses may be opened with a sharp knife, when they 'point,' and dressed with a wet gauze dressing, frequently changed, until the discharge has ceased. The smallest abscesses and boils should be treated with extreme care, as they are very liable in the Tropics to develop into ulcers if neglected.

The treatment of *Sprains* and *Fractures* must be learnt from one of the many small handbooks of First-aid.

Medicine Cases and Drugs.

For use in Africa no better case has been devised than the 'Congo Chest' (No. 250) of Messrs. Burroughs, Wellcome & Co., and in other countries, where it cannot be carried far, it is useful as a store to be kept at the base camp. A smaller case, which will fulfil most of the ordinary requirements, is the No. 231 case, weight about 7 lb. For the higher ascents, where only the barest necessities can be carried, a leathern pocket-case (such as No. 114, B. W. & Co.) should be taken. In all circumstances it will be advisable to take an additional supply of bandages and dressings, which cannot be contained in the case itself.

It is important that all drugs should be obtained fresh from the makers shortly before the departure of the expedition.

The following is a list of drugs, etc., which may be found useful in a tropical expedition:

Quinine bihydrochloride	gr. v.
Quinine bisulphate	gr. v.
Blaud pill	gr. iv.
Potassium chlorate	gr. v.
Dover powder	gr. v.
Iron and arsenic compound.	
Bismuth subnitrate	gr. v.
Ginger essence	min. x.
Potassium permanganate	gr. ii.
Calomel	gr. i.
Salol	gr. v.
Salicin	gr. v.
Laxative vegetable.	
'Livingstone Rouser.'	
Zinc sulphate	gr. i.
Opium	gr. i.
Aspirin	gr. v.
Phenacetin	gr. v.

Soda mint.	
Easton syrup	dr. ½
Cascara sagrada	gr. ii.
Ipecacuanha (sine emetine)	gr. v.

In addition to the above, which are taken in tabloid form, a supply should be taken of the following :

Pure carbolic acid.
Boric acid.
Castor oil.
Sulphate of magnesia.
Iodoform.
Lanolin.
Vaselin.
Sulphur ointment (1 in 10).
Ammoniated mercury ointment (1 in 10).
Iodine liniment.

And the following various articles :

Metal-handled lancet.
Dressing scissors.
Dissecting forceps.
Probe.
Clinical thermometers.
Caustic holder and points.
Suture needles and silk.
Safety pins.
Mustard leaves.
Adhesive plaster, 1 inch and 2 inch.
Court plaster.
Oiled silk.
Large supply of bandages of 1-inch and 2-inch width.
Supply of lint.
Gauze.

Equipment

(*These notes are merely intended to supplement, with special reference to the Tropics, the information on this subject contained in other chapters.*)

Food.

The mainstay of the 'Sahib' or 'Bwana' or 'Tuan' must be the same as the food of his men : thus, in a wheat country his food is flour, in a millet country, millet, and in a rice country, rice ; and to the ordinary Englishman the worst of these is rice. An important point to arrive at in selecting tinned provisions is to take as great a variety as possible. Though it is true that after a few months all tins, meat or fish or fruit, seem to have one and the same flavour, it is possible that a stomach jaded by a long course of beef or mutton may welcome jugged hare or curried prawns. It is worth while, too, to take a few tins *de luxe* for special festivals. In hot places there is often a craving for strong flavours, and a palate which shuns such things at home cries out for pickles and sauces. There is perhaps little need to say that all tinned foods should be obtained from the best manufacturers, and that any tin which shows a suspicion of 'bulging' should be at once discarded. It is probable

that no fresh vegetables will be available, and it is unfortunate that of those in tins the wet vegetables are too heavy for limited transport, while the dried variety are tasteless and require a long time for cooking: an exception must be made in favour of Murray Cooksley's dried potatoes, which can be strongly recommended. Failing vegetables, it is very important to eat fruit: dried apple chips, pears, prunes, peaches and apricots, more particularly the latter, should be eaten daily. Raisins and figs are good food, and are conveniently carried in the pocket with biscuits for lunch. Ginger is useful in counteracting the prevailing flavour of tin. Some of the cheeses, notably the flat Dutch variety, are a useful food, and should certainly be taken; nor should anchovies and olives be forgotten. In the higher regions there will be a strong desire—even stronger than in the Alps, possibly on account of the distaste for it in the hot country below—for butter, and this should be of the best kind: it is a good plan to take two varieties, as the flavour of tinned butters varies considerably. The usual drink will probably be tea, as coffee is heavy to carry, and is usually undrinkable as made by the native cook. A cup of cocoa before bedtime is an easily carried luxury. Condensed milk should certainly be taken in considerable quantities for use in sickness; the 'Ideal' brand of unsweetened milk mixes well with porridge or stewed fruit. A great saving in transport may be effected by the use of saccharine (or preferably saxin) tabloids.

The use of alcohol is a question about which no one will dare to dogmatize. It should certainly not be taken during the day, but, in the opinion of the writer, a small glass of whisky or, in the Dutch fashion, of gin at or before the evening meal adds to the enjoyment of monotonous food and assists digestion. A bottle or two of brandy should be taken for emergencies, and champagne is of great value in the convalescent stage of malaria or other fevers: this latter should be taken in pint bottles, which may be left at the base camp, whither sick men will necessarily be sent.

Canteen.

A great deal of ingenuity has been devoted to the invention of canteens, but most of them are useless to the mountain explorer, who can only afford to carry the fewest and most necessary articles. Weight may be saved by using plates of aluminium, and

cooking-pots may be of the same metal if it is possible to ensure their thorough cleaning. Kettles should be made of iron, and cups or mugs of enamelled iron; cups can be made to pack more conveniently one inside the other if the lower half of the handle is cut off. In those Eastern countries, where kerosene tins are used for the transport of provisions, an excellent fire-place can be made by using discarded tins laid on their side—a few holes are knocked in the top and the fire placed inside. Tins of the same kind can be easily adapted to the purpose of baking bread; and in this connection it may be mentioned that in countries where banana wine cannot be obtained, a very good substitute is yeast cakes, one tin of which (price about 1s. 6d.) makes bread enough for one man for six months: bread made with baking powder very quickly becomes dry and uneatable. Tin-openers are very liable to be lost or broken, and a quantity of them should be taken.

Clothing.

The most important parts of the clothing in tropical mountaineering are the head-gear and foot-gear. In the lower hills and in the early part of the day when the sun is really hot, a wide-brimmed hat or a helmet with a good protection for the back of the neck should be used; if the helmet is made of 'pith' it should be covered on the outside with the thinnest waterproof material, otherwise it becomes sodden and heavy with the first rain. Hats and helmets should be lined with thin red cloth; the latter are more cheaply bought in tropical towns than in this country.

The most careful attention should be devoted to the question of *boots*, and it is in all cases wise to take more pairs than are thought to be necessary. Most people will find it impossible to wear in the Tropics the heavy boots to which many are accustomed in the Alps; the excessive perspiration makes the feet soft and more easily blistered, and every extra ounce of weight is a serious consideration. The most suitable are ordinary nailed shooting boots, with a plentiful supply of spare nails or 'saccorb' screws for the higher ascents. It is a good plan to have the uppers made in one piece, i.e. with no seam down the back. In the Tropics all leathern objects become coated with mould in a few hours, and rot with astonishing rapidity, so that it is advisable to expose spare boots to the sun whenever the opportunity occurs. Dubbin, or some other preparation of the kind, should

be freely used.[1] At the end of a hard day it is the greatest comfort to be able to change into a pair of light and soft shoes or boots; when transport is very limited it will still be possible to carry a pair of Canadian moccasins. In the lower country and at the base camp it is advisable in the evening to wear mosquito boots (see above, Malaria).

Khaki or drill *suits* are more cheaply made locally than in this country; they should be made very amply, and large pockets provided. Sleeves are an almost intolerable nuisance in the lower ground, and they may be cut very short or dispensed with altogether. Shorts are cool and comfortable, but they should not be worn in places where leeches are found, and they cannot be recommended in any case, as the bruises and scratches on the knees are very liable to suppurate in hot climates. Trousers are preferable to breeches or knickerbockers, and light canvas anklets holding the ends of the trousers over the boots are cooler than putties. For underclothing every man must decide for himself. There are those who can wear woollen vests and flannel shirts in the Tropics; but both of those garments quickly become 'felted' with profuse sweating, and no amount of washing will restore their softness. Linen or cotton vests are easily washed, and are usually found to be the most comfortable. A flannel shirt and soft woollen sweater should be taken to wear at night in the mountains. Thick woollen socks, several sizes too large, will often help you to sleep on a cold night: a warm woollen cap is useful in the same way.

Cholera belts have been strongly recommended by some travellers, but they are often a source of danger rather than otherwise. The important thing to aim at is to protect the vital organs of the abdomen from chill during the night, and this may be effected by fastening a wide towel about the middle of the body; even in the hottest night this will not be found oppressive: the same purpose will be answered by a folded blanket, which may be pulled up and down over the shoulders and feet when the night becomes chilly. A light mackintosh cape or poncho reaching to the knees is of great use for wearing about the camp, when a dry change of clothes has been put on after a day's march.

[1] See also "Equipment," p. 82.

Of *beds* none has yet been found better than the ordinary X-pattern, but as this is somewhat heavy to carry, it will probably have to be left behind when the mountains are reached. In countries where bulky loads can be carried, the 'Wolseley' valise is of the greatest value. One load carries a man's bedding, spare boots, clothing and a variety of odds and ends, and the valise itself is used as a bed, which can be made tolerably comfortable by putting leaves and moss underneath it; if the flaps are sufficiently wide, the valise can also be used as a sort of makeshift tent. Blankets should be of large size (96 by 60 inches), and it will be found that two or three light blankets are better than a single heavy one; by sewing tapes at the edges of one of the blankets it can be converted into a sleeping-bag when required. Clothes should be carried, not haphazard with the blankets, but in thin cotton bags (about 30 by 20 inches): one of these bags, filled with soft clothes, may be used as a pillow; but the extra labour of carrying a well-made hair or feather pillow is more than balanced by the comfort it ensures. In mountain regions, where vegetation is luxuriant, a more comfortable bed can be made in this fashion: four Y-shaped pieces of wood are driven into the ground at intervals corresponding to the four corners of a bed; two short pieces of stiff wood are laid across the forks of the Y's at the head and foot of the bed, and on them are laid long saplings from one end to another—these are easily secured in their place by rattans or other creepers or fibres, which are sure to be found growing in such places, or by string. On the top of the bedstead thus made leaves or grass may be laid, and on the top of this the bedding. In places where there is no vegetation, and where the Wolseley valise cannot be carried, the bedding must be laid on a thin waterproof sheet, which should measure not less than 96 by 60 inches. Such a waterproof sheet may be of use in other places also: it is not generally known that fleas have a strong dislike to india-rubber, and in places where these little creatures abound a complete immunity from them may be enjoyed by sleeping on a mackintosh sheet.

Furniture.

A *camp-chair* is a necessity which must be carried as far as circumstances will allow. The best is the 'Rhoorkee' chair, which accommodates itself to the most un-

even ground, and can be taken to pieces and packed with the bedding; spare canvas should be taken for mending. A useful but less strong type is the X-pattern folding chair.

Washing Apparatus.—An aluminium basin with a canvas cover will hold all the necessary gear. Duplicates should be taken of everything, particularly sponges, which are very liable to be attacked and devoured by crickets. A pair of barber's clippers is indispensable.

Tents.

Tents are among the most important part of the equipment, and at the same time they present the greatest difficulty. In an expedition to high mountains in the Tropics every variety of climate will be experienced, from the sweltering heat of the plains to the alpine cold of the heights, and it will not be possible to carry tents suitable to all these conditions. The only thing to do is to effect a compromise by taking tents which will not be unbearably hot in the low country, and which at the same time are not too heavy to be carried into the mountains. The first of these requirements is met by using a tent provided with an outer fly—an absolute essential in a hot country; the second is achieved by making the tent such that the fly and the tent itself can be used separately when transport is strictly limited. One condition is certain to be met with at all altitudes, and that is the frequent and abundant rainfall; this makes it imperative that both the outer fly and the roof of the tent should be made of rain-proof canvas. In the lower country it is advisable to aim at the ideal of one man one tent, as the close proximity of persons in a small, hot tent is likely to lead to friction of another kind. The smallest compatible with comfort for one man is a 'Whymper' pattern tent, 6½ by 6½ feet on the ground, and 6½ feet high at the ridge. A tent of this size may be occupied by two people in the mountains, but a tent of 7½ by 7½ feet would be preferable, though heavier. The inner tent is slung from the ridge pole by loops about 6 inches long; the outer fly is stretched over the ridge pole, and should project beyond the inner tent not less than 1 foot at each end and 2 feet at the sides. The outer fly and the roof of the tent should be made of some form of Willesden canvas capable of withstanding a heavy downpour of rain; to ensure lightness, the ends and side walls of the tent may be made of a lighter

material, such as waterproof duck. Both ends should be made to open, and also to be laced up tightly in the event of heavy rain or strong wind or cold. Large pockets sewn on to the side walls, and a light cord stretched from end to end under the ridge, will be found useful. In heavily timbered countries a considerable amount of transport may be saved by discarding tent-poles and cutting wood for the purpose from the neighbouring jungle. If a belt of bamboos is met with, some of these may be cut and carried on from camp to camp. At the base or other long-occupied camp it will generally be found possible to build a house thatched with grass or leaves, which will be always cooler than a tent, as well as more commodious for the Europeans. One or more 'Mummery' tents for the Europeans may be taken for the final ascents of mountains. A great disadvantage of these tents, if made of some light waterproof material, is the excessive condensation that takes place inside them in places where the atmosphere is saturated with moisture.

Special attention must be devoted to the tents of the 'boys' and carriers, who, if they want less 'head-room' and less protection from the sun than their masters, require an equal amount of protection from the cold and rain. Their tents may be made without an outer fly, of the same material as above described, and it may be calculated that a tent of 10 by 6 feet with a height of $4\frac{1}{2}$ feet is sufficient for six men. A light rope should be sewn firmly along the outside of the ridge, terminating at either end in a free loop, which can be attached to a tree or to a post driven into the ground. The roof may be made sloping to reach the ground; more room, with a little extra weight and cost, is provided by bringing the roof to within 1 foot of the ground and sewing to the edge of it a hanging wall or valence 1 foot wide. To accommodate a large number of men, a good plan is that practised by the Dutch army in the East Indies. Two upright poles are driven into the ground, and a horizontal pole tied from one to the other at a height of about 7 feet. Many poles 12 to 15 feet long are then laid about 1 foot apart, with one end on the ground and the other resting on the horizontal, to which they may be tied by rattan or cord; the angle at which these poles are laid should be as low as is consistent with the waterproofness of the roofing material, and they may be

strengthened by tying horizontal poles across them at intervals of 2 to 3 feet. On the structure thus made, which resembles the framework of half the roof of a house, is laid a light Willesden canvas 10 feet wide, and of a length calculated according to the weight of the material and the average loads carried, and to the number of men to be accommodated. It is obvious that such a shelter, which gives plenty of room and has many advantages in a hot climate, can only be made in districts where timber is plentiful, and is not suited to cold weather, nor to places where strong winds are frequent.

It is advisable to provide each man with a waterproof ground sheet measuring 72 by 30 inches ; an even better plan, which will cause much gratification and goodwill, is to give to each man a waterproof canvas sack of the same dimensions, which he can use as a ground sheet or as a sleeping-bag, and at all times as a ' hold-all ' for his clothes and personal belongings.

Management

Loads and Packing.

The conditions of transport vary so much in different places—in one place men carry loads on their heads, and in another on their backs : here they carry a 60-lb. load, there only 40 lb., and so on—that it is impossible to specify in detail here the size and shape of the loads, and only a few general principles can be suggested. After finding out the local conditions, it is important, so far as it is possible, to pack provisions in loads as they will be required, so that it will not be necessary to open one box for salt, another for meat, another for jam, and so on. By a careful calculation it will be possible to pack the boxes with all (or most of) the food required for a certain number of days. The ' Vanesta ' case of three-ply wood (made by the Vanesta Company) is by far the lightest and strongest box for packing provisions and other gear. The boxes should be made of the size suited to the local conditions of porterage, and each one should be fully addressed on the lid, and a number attached with reference to a list of its contents ; it is advisable also to put the numbers on the *ends* of the boxes, so that when they are all piled up on board ship or at the base camp or elsewhere, a sought-for box may be found with the minimum of trouble.

When their contents have been used, these boxes should not be thrown away, but should be kept for the use of natural history specimens or other curious objects found during the course of the expedition.

All loads should be as nearly as possible of the same weight, but some will necessarily be heavier than others, and a few days' experience of the men will suffice for their proper distribution. Much time will be saved at the beginning of the day if the same man always carries the same load. Double loads are to be avoided at all cost. Personal loads, i.e. bedding, tents, kitchen apparatus, and other things that may be wanted on the march or as soon as camp is reached, should be given to strong men who are not likely to dawdle behind the caravan. If it can be arranged, it is wise to have one or two spare or lightly loaded men to take up the burdens of any who fall out by sickness or any other accident.

Trade Goods, Natives, etc.

In Africa, where the manufactured products of civilization have penetrated even to the remotest districts, the question of trade goods is a constant worry. Every inquiry, therefore, must be made beforehand as to the kind of goods required in the district to be visited and in the regions to be passed through on the way. But fashions are constantly changing; on one side of a river you can get nothing without brass wire, and on the other glass beads are the only currency: if the people ask for small white beads nothing will induce them to take your large red ones; so it is necessary in those places to go provided with many different kinds of goods to suit the local tastes. Salt is in some places of the greatest value for barter, and in places where the people understand their use, fish-hooks are greatly appreciated. In unexplored regions, such as parts of New Guinea, where the natives have received nothing from the outside world, the question is simpler, and it is only necessary to take those things which the people are certain to appreciate, such as glass beads, red cloth (turkey twill) and straight knives. Even the most uncultured of "savages" are expert barterers, and it is advisable to establish a definite scale of payment—such as, for example, one bead for one sweet potato, a piece of cloth for a spear or club, and so on. They are quick to appreciate justice and honesty, and attempts on the part of the carriers of the expedition to defraud

them must be checked. On first coming into contact with a new tribe it is necessary, without making a display of force, to be on the watch against a treacherous attack. Presents should be given to the head-men and (if they are seen) to the old women. It is well to learn and practise the native form of greeting, and to submit to any ceremony of blood-brotherhood or the like. If it is possible to learn the names of individuals and to so address them, it will always be appreciated as a compliment. Undue familiarity between the carriers of the expedition and the native women will inevitably lead to trouble, and should be severely punished. It is unwise to point at native people, and (in some cases) to laugh at them. Unless they are travelling with the expedition, natives should never be allowed to remain in the camp after nightfall. Medical treatment is one of the surest ways to win the affection and respect of the 'savage,' and castor oil or bandages will often make a way easier where words or rifles would be of no avail.

Carriers, etc.

The management of the carriers themselves is a matter which can be learnt by experience alone. Generally speaking, it may be said that a just and strict impartiality to all men is a foundation of their good services; men of all colours are quick to notice and to take advantage of the smallest sign of weakness or of favouritism on the part of their master. Cases of insubordination or other faults must be punished in some way; but, unfortunately, the use of the stick, which alone among certain races appeals to the delinquent (and is indeed expected by him), is forbidden by the constituted authority, and an infringement of the rule leads to trouble after returning to civilization: the appeal to the pocket by cutting off a part of the man's wages is the most effectual punishment that remains. One of the most annoying troubles that the leader of an expedition has to contend with is malingering. This does not often present much difficulty to anyone with a knowledge of medicine, and others may often detect it by means of the clinical thermometer; the most appropriate punishment for it is the administration of a powerful purgative. Finally, it may be said that very little trouble will be experienced if the men have hard work, adequate food, tobacco, and days of rest at stated intervals.

Camps, and Things in General.

When a camp is made on the banks of a river, the tents of the Europeans should be pitched upstream of those of the men. A careful examination of the high-water mark should be made before the tents are pitched.

The cook-house should be made within a very short distance of the Europeans' tents, as it rains more often than not at the time of the evening meal.

A good ' boy ' is one who has a fire going to make tea while the camp is being pitched.

At a base camp latrines should be constructed, and at a temporary camp the men should be instructed to go to a certain definite distance.

Trenches to carry off water should be made round the tents, even if there seems to be no probability of rain.

In choosing a site for a camp, avoid as far as possible the proximity of a native village ; and if strong winds are frequent, avoid the neighbourhood of large and decaying trees.

The leader of an expedition should often personally supervise the distribution of rations to the men ; and, except in the case of very large expeditions, he should always supervise the apportionment of loads at the beginning of a journey.

Flies are often an intolerable nuisance in a camp ; they may be driven out of the tent at dusk by putting a lamp outside and then shaking the roof of the tent, so that they are unable to settle : after a few minutes they will have settled elsewhere and the lamp may be brought inside.

The following is a list of articles which might be overlooked in preparing the equipment for an expedition : A spring balance for weighing loads ; a steel measuring-tape ; a cold chisel ; wire for mending ; assorted nails and screws ; a housewife with needles and cottons, etc. ; stencil and ink for marking boxes ; a small electric torch ; many bootlaces ; spare watch-glasses ; a flint and steel ; pocket-books in which notes can be written in duplicate.

Finally, it may be appropriate to quote the advice given by a distinguished traveller, the late Mrs. Bishop : " Never take anything you can possibly do without." To this we might add another counsel : Take everything you are likely to require, and leave things behind when they can no longer be carried.

CHAPTER XII

MOUNTAINEERING IN THE ARCTIC (SPITSBERGEN)

BY SIR W. MARTIN CONWAY

SINCE the expedition which I took to Spitsbergen in the years 1896 and 1897, I have not heard of any parties of mountaineers going to that country. Mountains were incidentally climbed by the Russian-Swedish surveyors, who went up there in several successive years to measure an arc of the Meridian. Indeed, they discovered and climbed the highest point in the main island, which Garwood and I had beheld afar off in 1897 but were unable to reach. Mountaineering, however, was merely an incident in the work of those parties. It has always seemed to me strange that English climbers have never followed our example in the Far North, and it is therefore with little hope of being very serviceable that I now accede to the request of the editor of this work to contribute a chapter on "Arctic Mountaineering," and how to set to work about it. Truth to tell, my own memory of details has become feeble; but such as it is, it shall be placed at the reader's service.

The first question, of course, is how to get to Spitsbergen, and having got there, how to get away from it; for though tourist steamers not infrequently visit the western coast of the main island, they stop so short a time as to be useless for even the briefest mountaineering expeditions. The climber who wishes to have the best of the season should arrive not earlier than the end of June, and start away at latest towards the end of August, when the sun has already begun to set.

Modes of Access.

Nowadays a good many industrial enterprises, such as mines and, I believe, quarries, are being prosecuted

in Spitsbergen, so that there must really be plenty of opportunities of being carried thither from Tromsö and brought back again; but it is impossible to predict beforehand what they will be. Probably the easiest way would be to make arrangements with the owner of one of the Tromsö or Hammerfest fishing sloops to convey the party up to its selected base and call for it again on a day fixed in advance. The price that should be charged for such accommodation ought to be moderate; but my experience of the North Norwegians was that they are liable to open their mouths pretty wide when they think they have a traveller in their power. In any case, such arrangements are best made by an agent long in advance and with all legal exactitude.

Equipment and Outfit.

The equipment necessary for Spitsbergen mountaineering need not be very elaborate. The temperatures to be faced will not exceed those of an ordinary English winter, and clothes will therefore not require to be of the Arctic character we associate with Polar expeditions. But a man does need to be really warmly clad with plenty of thick underclothing and thoroughly strong garments. For when the wind blows and the snow drives on the higher levels it is cold enough even at Midsummer, though on rare occasions in still air the warmth of the sun may be felt to a quite surprising degree. Near the sea-level and on the moraines and rocks the strongest mountaineering boots are none too strong. I doubt whether the ski-ing boots commonly worn for winter sport would adapt themselves for use in such places. Once the upper levels of the glaciers have been gained, which generally involves two or three days' work with sledges from sea-level, travelling becomes easier and more agreeable, and is done almost entirely on ski. Sledges, ski, warm sleeping-bags, goat-hair stockings and warm clothing generally can be bought very well at Bergen or Trondhjem on the way out; but it would be well, as far as the sledges are concerned, to write beforehand and make sure that they would be available. British consuls at those places or the Norwegian Consul-General in London would doubtless inform inquirers as to the names of the best shops to deal with. Reindeer sleeping-bags are delightfully comfortable and warm, but they are distinctly heavy and bulky. Good eiderdown sleeping-

bags with a rug or two would, I think, be quite warm enough till the 20th of August at any rate. The best tents to take are relatively large tents of the 'Mummery' type, made of strong Willesden canvas with rubber sheeting floor sewn in. It is absolutely essential that the floor should be sewn in, otherwise the tent could be easily blown away in a gale. I do not remember the exact arrangements of the tents of this kind made for me by Edgington's. The floor space was probably about 6 feet or 6 feet 6 inches by 4 feet. The height may be judged by the fact that for poles we used ice-axes, with extra pieces about 18 inches long to fit over the points with a socket to lengthen them. Three or even four people might be crowded into such a tent, but no one would wish to share such a tent with more than one companion on a pleasure journey of a few weeks' duration. The remainder of the kit would consist of cooking apparatus and supplies, to wit, a primus stove, some aluminium plates and pans, aluminium spoons and forks; and for provisions the usual tinned goods, concentrated soups and pots of jam, and a sufficient quantity of highly nutritious biscuits to take the place of bread. Far the best biscuits for this purpose we found were named 'Triticumina,' which contained plasmon; but the biscuits which have currants sandwiched into them form a very welcome change.

A liberal supply of brown sugar in tins should on no account be forgotten, though jam is almost as good. If the party contemplate spending their time in one district of the island, they will probably make for themselves a heavy and comfortable base camp, which may be as well stored as they please, as it will, of course, be situated close to the shore of some bay or harbour, and everything belonging to it will be landed direct from the boat, so that the question of porterage will not arise. This base camp ought to be equipped with a rowing boat of the type called a whale boat, such as can be readily hired from any North Norwegian port. It would be well to have one or two able-bodied Norwegian sailors to man the boat and help drag the sledges, and no difficulty would be experienced in finding in or about the Lofoten Islands suitable men, skilful also in going on ski. Our experience was that young unmarried men were to be preferred. The others got home-sick.

Plans of Campaign.

A mountaineering expedition to Spitsbergen might lay out its plans on many different lines, but, broadly speaking, there are two main choices between which to select. In one, the mountains of the coast region accessible directly in one day, or at most in two days, from the sea would be the principal object of attention. In the other, the high interior regions of inland ice remote from the shore, and the mountains rising out of them, would be the goal. There is much to be said for either plan. The former would be the less laborious and the more comfortable; the latter harder work, more adventurous, and opening up a stranger and more wonderful world. There is also a third region, that of the unglaciated, boggy valleys around Advent Bay and Bell Sound; but this, after a season's experience, I cannot honestly recommend as pleasant travelling country.

From the Coast.

Let us then take the other two alternatives one by one. Climbers who would hug the coast may go up with a fairly large party prepared to subdivide on arrival, and pitch base camps in different bays if so they please. But a large party is, of course, not essential, and a couple of good friends, with one or two Norwegian sailors at their disposal, would have a very good time on shore or afloat in their whale boat. Having chosen a well-protected landing-place with a shelving beach up which to haul their boat, and having pitched their tents well out of reach of the highest tides and storms, they could either climb the mountains close at hand, or they could row off or sail away in their boat to any others accessible from their fjord, taking with them a light camp and provisions only for two or three days. Or, again, they can make short trips of one or two days' duration merely into the interior, not cumbering themselves with a sledge, but carrying on their backs a very light camping equipment of a kind brought to much perfection by the Amateur Camping Club. On this system the same base camp need not be adhered to for the whole season, but in suitable weather it could be moved, by help of the whale boat, even from one of the western fiords to another.

The great question which naturally arises is what sites by the seashore are best suited for climbing centres. Broadly speaking, the north half and the south toe

of the main island alone come into consideration, for the east islands are not practically accessible, nor would it often be wise to make a sea-base at all far to the eastward on the north coast. Practically, therefore, we may take the coast-line round from Wijde Bay westward and then southward down the coast to King's Bay, then all along either coast to Foreland Sound to the mouth of Ice Sound, whilst at the south end of the island only Horn Sound need be considered.

Coming now to detail, in the high summer of a very open season, when the ice-pack has withdrawn to somewhere in the neighbourhood of 80° 30″, it might be safe to make a base camp for a week or two in Wijde Bay itself, preferably on its eastern shore, from which the high peaks of 7000 feet and thereabouts, which range down the west side of New Friesland, can be climbed in a two-day expedition. These peaks are very indifferently explored; only the highest of them has ever been climbed; they stand in the midst of a region of extraordinary interest, and must command wonderful views to the eastward over the little-known north-east land and away off to the romantic Wyches Islands. Probably there is no district in the whole Archipelago which would so well reward the season's work; whilst if the ice-pack were to come down and seal the mouth of Wijde Bay, retreat is always open overland to Cape Thordsen in Ice Sound by one or other of two obvious routes.

A less heroic base could be found at a dozen points near the north-east angle of the island, and this is probably the best and most practical region to choose; for here it would be possible to shift the base camp every few days, whilst there are any number of mountains rising from the coast built of the hard primary rocks and apparently offering delectable scrambles. The main bay, called Mauritius Bay by the Dutch in the old days, and in particular the south-east corner, would probably be the best place to begin. The labyrinth of glaciers that empty into Redcliff Sound must be well worth a visit, and the same is true of the peaks and glaciers of Magdalena Bay. The fact that the whole of this region has been admirably mapped by the Prince of Monaco is a further advantage for the prospective climber. Between Magdalena Bay and Close Cove (now wrongly called Cross Bay) there is no place for a base camp; but

Close Cove, King's Bay, Cove Comfortless and the north part of Prince Charles's Foreland form together an enclosed area containing innumerable excellent coast-line bases. Probably one of the narrow bays at the head of Close Cove would provide an attractive situation, besides giving access to an intimately glaciated and beridged interior. But the south-east extremity of King's Bay, as we found, is a delightful situation, and from it the Three Crowns and countless other peaks can be reached. Prince Charles's Foreland has been excellently mapped by Dr. Bruce, and seems to have some good climbing peaks, most of which, and all of those along the opposite side of Foreland Sound, await their first experience of a human foot. It must be admitted that the region nearest the west coast suffers from the worst weather, for it continually happens that the clouds lie low, whilst above the level of 1000 or 1200 feet there is brilliant sunshine for days and perhaps weeks together, and of course no night at all. From Horn Sound in the south some splendid peaks are accessible, only one of which has ever been climbed. This is perhaps the best place for a week or two at the close of the season, though it might be rather difficult to get there in an open boat from the northern parts. The hospitality of some passing steamer, however, might be available for such transfer.

Into the Interior.

Far more interesting and delightful, however, than merely climbing peaks from a sea-base is a bold venture into the far interior. Indeed, a climber standing on the summit of any peak and looking inland over the vast glaciers and at the countless ranges and beautiful mountains spread abroad before him on a clear day will, I think, be irresistibly drawn into that white labyrinth. Of course the most delightful experience is a traverse of some part of the island from sea to sea. This requires a good deal of organization, because it is necessary to have a boat to meet the party arriving from the other side at some point arranged in advance. From Magdalena Bay to Cross Bay the traverse has been made, and leads through splendid scenery. More interesting, because new, would be the traverse from Wood Bay to King's Bay, or from King's Bay along the King's Highway and down to North Fjord ; or again, from the head of Sassen Bay

over to the east coast and back. It would scarcely be possible to have a boat prepared to meet a party on the east coast, so that either from Ice Sound or Bell Sound journeys to the east coast must be made to and fro by the same route. In the nature of things little general advice can be given for such expeditions; each must be organized according to its own special circumstances. It is obvious, in any case, a large margin would have to be provided for the unexpected. A sledge may break down, or delays may be caused in a thousand ways, so that a considerable reserve stock of provisions must be taken. The first day from the coast, sometimes the first two days, will be very laborious. A sledge and its load will have to be carried by repeated journeys over rough ground and generally over broad moraines before the camp can be pitched at the edge of the clear ice. Then, generally speaking, there will be a crevassed region to traverse, where progress must be slow; but after two or three days at the outside easier conditions will be met with. Soon, however, the snow-covered belt of the glacier will be reached, and as at this time of year a slight but continuous thaw is proceeding, it necessarily follows that, where there are no crevasses to drain off the water, there will be a wild belt covered with water-logged snow and intersected by wide and rushing streams which it is often very difficult to cross. The water-logged snow is merely unpleasant and laborious, as the ski and the sledge will sink into it, and every hollow thus made is instantly filled with ice-cold water. The only way to deal with the big streams is to follow up alongside of them till they divide into smaller brooks which can be crossed in detail. Yet higher up, however, the thaw is left behind and a splendid hard surface is found, over which ski-ing and sledging are a pleasant pastime, and longer distances can be covered in a day's march. Out of this higher region peaks, of no great absolute height indeed, but of fine form, arise in all directions, and from a suitably chosen high camp it will be possible in a few days to make many ascents, either of summits in the ranges bordering one's own glacier on either hand, or in other ranges behind them which can be readily reached over undulating passes.

A traveller who has made one such expedition into the interior of Spitsbergen will have become acquainted

with glacier phenomena such as no ordinary alpine region can display. The pools and ice caverns of Arctic glaciers, the strange blue river-tunnels through the ice, the burst lakes scattering huge ice-blocks afar, the curious sheaves of crystalline ice-rods, the rivers of water stained crimson by disintegrating dolomite rock and flowing over the white ice-like veins of jasper in marble, the frozen heaps of ice, in shape like volcanoes, which rise where springs force themselves out of the ground—these and many other strange and beautiful sights await the student of glaciers in the Arctic regions. Moreover, the glaciers themselves have quite a different look from alpine glaciers. They appear to be far more viscous, as in fact they are, so that if they end on a piece of flat ground and do not reach the sea, the end spreads out into a great round mass, as a stream of honey might if it emerged from some narrow gap on to a flat area. But where a glacier reaches the sea, and especially a great glacier perhaps seven miles in width, it has to terminate, of course, in a splendid cliff, and this cliff is, as it were, made of towering *séracs*, blue in the hollows and white on the crown, in height perhaps 100 feet above the water-level, and these *séracs* are continually falling into the sea and breaking up into little icebergs, causing a great commotion in the waters as they plunge in their fall and jostle against one another till they come to rest.

Exceptional and Beautiful Phenomena.

Nor must I forget to mention another of the great glories of this mountain region, to wit, the long sunset. Towards the middle of August the sun, in the hours corresponding to midnight, approaches close to the horizon, and presently actually dips beneath it. It follows that a sunset colouring, paler and more delicate but not less beautiful than that we know in the Alps, illumines the sky, the clouds, the mountains and the glaciers at this time, and that not merely for a few minutes but for four or five hours on end, according to the atmospheric conditions. I know of nothing more wonderful than to climb a mountain which commands a wide view over the flat, fog-covered ocean and the clear, snow-covered interior when the whole of this enormous expanse shines pink in the lights and blue in the shadows, and the effect lasts on for four or five hours spent amid such surroundings.

But it is not my business to describe the beauties of Arctic scenery in this place, but only to indicate as best I may how the intending mountain traveller in those regions may set to work. Conditions, of course, of accessibility and the like change from year to year, especially nowadays when Spitsbergen has become the scene of industrial undertakings; it will be necessary for any intending traveller to make inquiries well ahead as to the circumstances attending his own case. I feel convinced, however, that an enterprising party of three or four climbers could spend a season in Spitsbergen and have an excellent time at not more than twice the cost of a corresponding season in the Alps, and possibly for a good deal less. Ingenuity, adaptability and enterprise will be essential. After all, for what kind of travel that is worth while are they not?

Summary, Cost, etc.

Note.—The foregoing was written before the war. Recent commercial developments have made Spitsbergen much more easy of access.

CHAPTER XIII

THE CAUCASUS

BY HAROLD RAEBURN

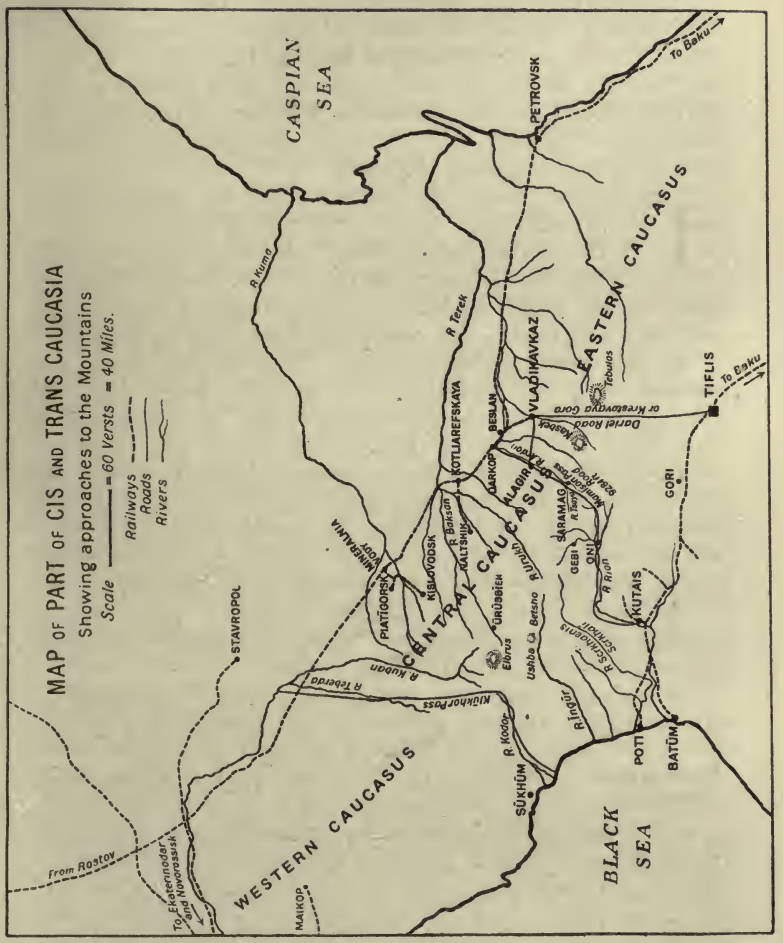
THE Caucasus of the mountaineer is that more or less continuous chain of great glaciated peaks which extends for nearly 600 miles between the Caspian and Black Seas.

General Topography and Structure.

Geographically, the water-parting of the ridge forms the boundary between Europe and Asia. Politically speaking the mountains run, with a general south-east to north-west direction, through almost the centre of the Russian province of the Caucasus, dividing it into the two districts of Cis-Caucasia, with the chief city of Vladikavkaz, and Trans-Caucasia, with Tiflis as the centre of government. Situated in about the same latitude as the Pyrenees, with a more continental climate, the ranges of temperature are much greater than in the Alps.

In such an extensive tract of elevated country great variation of conditions must naturally occur. Speaking generally, and with more special reference to the central group of summits, the glaciation is somewhat less than in the Alps in proportion to the elevation, about 2000 feet greater than that of the central Pennines. The average level to which the glaciers descend is rather higher. As the average slope of the mountains is more abrupt, the glaciers are steeper. In consequence, the Caucasian glaciers are as a rule more difficult and broken, and the ice-falls more continuous.

The prevailing wind is warm and moisture-laden, blowing from the south-west, off the almost sub-tropical shores of the Black Sea ; condensed by the cold peaks, the moisture is thereon deposited in the form of snow. Thus, in spite of its northern aspect, the glaciation of the European slope is little greater than that of the southern.


MAP OF PART OF CIS AND TRANS CAUCASIA
Showing approaches to the Mountains
Scale ——— = 60 Versts = 40 Miles.
Railways
Roads
Rivers
CASPIAN SEA
BLACK SEA
WESTERN CAUCASUS
CENTRAL CAUCASUS
EASTERN CAUCASUS
PETROVSK
To Baku
R. Kuma
R. Terek
VLADIKAVKAZ
Dariel Road or Krestovaya Gora
TIFLIS
To Baku
KOTLIAREFSKAYA
BESLAN
DARKOH
NALTCHIK
R. Baksan
KISLOVODSK
PIATIGORSK
MINERALNIA VODY
STAVROPOL
From Rostov
To Ekaterinodar and Novorossisk
MAIKOP
R. Kuban
R. Teberda
KLUKHOR PASS
R. Kodor
SUKHUM
R. Ingur
POTI
BATUM
R. Rion
KUTAIS
GORI
SARAMAG
R. Iori
QNIL
GEBI
Ushba
Elbrus
Betsho
Kazbek
Tebulos

The height at which trees cease is very much the same on both sides (7000–8000 feet). A feature of the country is the great forests which cover the upper basins of many valleys, particularly on the south side.

In many of the southern valleys these forests are composed of deciduous trees of various species, such as birch, beech, oak, maple and chestnut, giving a variety and charm which the more sombre pine forests of the north do not provide. Some of the northern valleys are destitute of timber, and the fuel difficulty is one which confronts the climbing explorer.

The whole mountain system may for present purposes be divided into three principal groups.

1. All the peaks south and east of the line of the Dariel, more correctly the Krestovaya Gora, Pass; in which though many peaks exist as high as the Oberland Mountains, yet the glaciation is not continuous for long distances.

2. The great central group. This is the most important and best known. It extends from Kasbek, immediately west of the above pass, to the Klukhor Pass, west of Elbrus, a distance of about 130 miles.

In the whole of this distance there is only one driving road, that of the Mamison Pass (9280 feet), the highest road in Europe. All other routes across the range, except one or two grass passes, must be made over glacier passes, the lowest about 10,500 feet above sea-level.

3. West and north of the Klukhor Pass lies a tangled group of somewhat lower glaciated summits, some of which are still unascended.

If we pass over the ancient traditions and tales of the Arabians, Greeks and Jews, mountaineering in the Caucasus is of very modern growth.

Records and Literature. The Arabian Kaf, the Jewish Ararat and the great mountain celebrated by Æschylus as the prison of Prometheus, are all situated in or near the Caucasus range; whether it be true or not that the Tower of Babel was built not far from the borders, this mountain land remains a Tower of Babel to this day.

In the city of Baku there are even now said to be one hundred different languages and dialects spoken. The Caucasus Mountains themselves give homes to as many tribes and dialects as there are rivers.

These tribes were almost always more or less at enmity amongst themselves. This lack of nationality rendered

the task of absorption by Russia an easy one. It should not be forgotten that a good part of the Caucasus proper was not conquered by Russia. The nominal sovereignty possessed by the kings of Georgia over many of the mountain tribes only began to be made real when the last king placed himself under Russian protection.

This great diversity of peoples, languages, religions and customs renders travel in the Caucasus, if more interesting, much more difficult. Most of the people know nothing of Russian, and it is therefore necessary for a climbing party to have an interpreter with them who has knowledge of as many of the different languages as possible. Apart from the fabulous, the earliest effort of mountaineering in the Caucasus appears to have been an attempt to ascend Elbrus by a party of four savants, attached to the politico-geographical expedition of General Emanuel, in 1829.

The first writer to draw attention to the Caucasus as a field for mountain exploration was the Rev. H. B. George, in a paper read before the Alpine Club on 2 May 1865. The pioneer expedition was that of Messrs. Freshfield, Moore and Tucker, with François Dèvouassoud, in 1868. Mr. Grove's party followed, in 1874, and his book, *The Frosty Caucasus*, is now a valuable alpine classic. During the '80's British mountaineers, with Swiss guides, conquered the majority of the highest peaks. Mr. Cockin was the most successful: three of the greatest peaks fell to him and his guides in one season. Messrs. Dent, Woolley and Holder were also very successful.

My Climbs in the Alps and Caucasus, by Mr. A. F. Mummery, describes his expedition in 1888, when the great peak of Dykh-Tau was ascended.

In the '90's a number of British guideless parties went out, but from various causes had little success.

Since then, in spite of three splendidly illustrated volumes, *The Exploration of the Caucasus*, by Freshfield and Sella, in 1896, *Aus den Hochregionen des Kaukasus*, by Merzbacher, in 1901, and *Kaukasus Reisen und Forschungen*, by de Déchy, in 1904, British interest in the district has been slight. Messrs. Longstaff and Rolleston had, however, a very successful guideless campaign in Suanetia, in 1903.

A Russian author, Afanasief, published in German,

in 1913, a very useful little compendium of the ascents made up to date, *100 Kaukasus Gipfel.*

As a proof that the Caucasus as a new mountaineering centre is still very far from being exhausted, British expeditions in 1913 and 1914 succeeded in effecting the ascents of ten new summits, none of which was below 13,500 feet in height.

Routes of Access.

The easiest, cheapest and quickest way to the central group from London is that to the north side, overland. The route is via Berlin, Warsaw and Rostoff on the Don. Thence either by the Baku train to Beslan, for Vladikavkaz, or by the Russian Spas express to Mineralnia Vodé, for Piatigorsk. An even better starting-point for the mountains is Naltshik, to which a branch railway, opened in July 1912, should run in two hours from the junction on the main Rostoff-Baku line of Kotliarefskaia.

The south side may be reached by driving from Vladikavkaz or from Darkop on the main line over the Mamison Pass.

Another excellent way of reaching the south side of the range from the north side would be by taking the motor service (office in the annex of the Grand Hotel) from Vladikavkaz over the Dariel—correctly the Krestovaya Gora—Pass to Tiflis, and round by the Tiflis-Batum railway. The motor line passes close under the huge mass of Kasbek (16,546 feet), and its glaciers can be reached in a few hours from Vladikavkaz. The old route to the south side of the range followed by most of the earlier English parties is that by Vienna and Odessa, thence by steamer, in from two to four days, across the Black Sea—calling at Sevastopol—to Batum. From Batum a short branch-line connects with Kutais. From here the Mamison road leads up to Oni on the Upper Rion, and can be utilized for driving for part or the whole of the distance, according to which valley or group of peaks it is desired to visit.

For the most westerly group, that lying west of Elbrus, the port of Sukhum Kalé on the Black Sea will probably be found most convenient. For the extreme eastern groups Tiflis will prove the best starting-point.

Modes of Travel.

The usual, and the best mode of travel in the mountains is on foot. All the railhead towns mentioned are more than a day's march distant from the hills. Kasbek alone is closely approached by a motorable road.

At the towns elected for approach—Tiflis, Kutais, Vladikavkaz, Piatigorsk or Naltshik—it is necessary to engage vehicles or horses, and a cook-interpreter. Whether it is advisable to buy horses for the whole journey depends upon whether much travelling, and in consequence little climbing, is to be done. The purchase of horses sets the party free from the endless haggling, delay and annoyance which seem inseparable from hiring. On the other hand, the purchase necessitates engaging at least one man for every two horses, and this adds greatly to the expense and to the commissariat difficulties.

Though considerably improved of late years, the various roads up Caucasian valleys, where they exist at all, are not of the best. A Russian road on the steppe is not a road in the usual sense of the word; it is merely a part of the ground over which one drives, and is not made in any way except by the wheels of passing traffic. The road of the Mamison Pass is a built road; but it is exceedingly rough in places, and is frequently interrupted by landslides, tree-falls and avalanches.

The most comfortable vehicle to obtain is the troika or phaeton, a light, low carriage something like the alpine char. A rougher and more usual carriage is the lineika, seated like a low-set Irish jaunting-car on four wheels. It is wonderfully elastic, its light, loose method of construction allowing it to adapt itself to the potholes, boulders and tree-trunks of the rougher parts of the road. Most of these vehicles will be found to suffer from the general debility consequent upon extreme old age. It is advisable to have each one carefully inspected before the start.

In the more out-of-the-way parts, where such luxurious modes of travel cannot be indulged in, an arba can often be obtained. This is a light, springless two-wheeled cart. It is often drawn by a pair of small but strong oxen, and though the pace is very slow, a large quantity of baggage can be conveyed in one.

The horses — almost invariably mares — are small, light animals showing evident trace of Arab blood. They are docile, free from vice, and marvellously sure-footed. Indeed, in this last respect they far surpass an average mule. Some of the 'horse passes' on the south side of the range would be considered by most people impossible for horses and more fitted for goats.

The saddles are Turkish, i.e. with a high pommel in front and behind. Some travellers have recommended taking out an English saddle. Few riders, however, would be able to retain their seat on an English saddle while their mounts were scrambling down or up the precipitous broken bank of some ravine or bed of a glacier stream.

Centres.

As in the Alps, so in the Caucasus, more climbing will be got by settling at a centre than by travelling about from one place to another. On this method the necessity of carrying heavy tents, large supplies of stores, etc., is avoided. A couple of light tents, to accommodate two or three men each, are all that is necessary.

Good centres for the various districts are, on the north side, Urusbieh, Chegem, Balkar, Bezingi, Stirdigor and Dsinago; in the Tsaya valley, the sanatorium kept by M. Sanghiev in the pine forest near Rekom; the inn at Saramag on the Upper Ardon; the Russian road-houses of Kalaki on the north and Tshantshakhi on the south side of the Mamison Pass; Gebi on the West Rion River; Ushkul on the headwaters of the Ingur; Mestia or Mulakh on the Mulkhora; and Betsho just below the giant precipices of Ushba. To Gebi and Tshantshakhi Kasarma on the south, and to most places on the European side of the range, driving should be *possible* nowadays.

Equipment and Commissariat.

Mountaineering in the Caucasus is still very much on exploring lines. Save in the case of Kasbek or, in a minor degree, of Elbrus, no huts, guides or organization for climbing exists. The success of an expedition must therefore largely depend upon the care and forethought bestowed upon the equipment and organization of the party before it leaves railhead.

The climbing equipment should be exactly similar

to that of the Alps; but as anything lost cannot be replaced, everything must be at least in duplicate. Indeed, it is advisable to take out three pairs of climbing boots—the odd pair for the purpose of lending to porters if it is found necessary to take them over a glacier, since it is not fair or safe to take heavily loaded men with 'gloved' feet up steep and slippery ice and snow. Two ice-axes are essential: one may easily get broken, lost or stolen. Tents, of any of the lighter English makes, are best taken out. Eastern bags, with padlock and key, are the most convenient method of carrying spare clothes. Among these, two or three complete changes of underclothing—of course all wool—are necessary. Plenty of spare flannel collars and abundance of stockings, and, of course, undersocks, are well worth their slight extra weight. *Crampons* are almost a necessity, though cumbrous and annoying to carry. It is advisable to have a tin case for these. They are of immense service in levelling up the good and the inferior icemen of a party, and in conserving the energies of the step-cutter, or step-cutters, for really difficult work on rocks or ice slopes higher up.

With two pairs of new—but broken-in—modern mountaineering boots it ought to be quite unnecessary to take out nails, iron boot anvil or hammer for a two months' campaign.

The general stores—cooking utensils, plates or bowls, cups (mugs are preferable), table cutlery, travelling stoves (primus and alpine), candles, etc.—are best obtained in the country. The most convenient packages are strong baskets. These should be made at home, and covered with strong waterproof material. Size 25 inches by 15 inches by 11 inches is convenient for horse carriage, and should be furnished with a strong lock. They can also serve as seats in or outside the tents.

The personal equipment should include a roll-up mattress—hair is the best—6 feet 6 inches by 2 feet 4 inches, a down quilt or sleeping-bag and a small pillow. If the tent has a ground sheet, a waterproof cover for the mattress is not required. To save trouble and expense on the journey and at the Customs, it is much the best plan to bring as little as possible into the country in the way of consumable stores. Jam is perhaps the one exception. For high work jam is of great importance,

and the little ¼-lb. tins to be obtained in London are extremely convenient. A few soups—powder or tabloid—are also useful for emergencies. Excellent shops are to be found at all the chief railhead towns, such as Tiflis, Vladikavkaz, Piatigorsk and Naltshik; also at Kutais and Oni on the Mamison road. In them almost everything obtainable in western Europe may be got.

Many different kinds of tinned meats, fruits and fish are to be had, but the party would do well to have as little to do with these as possible, except perhaps a few boxes of sardines. In the country, mutton, fowls and eggs are always to be obtained, and these are safer and more palatable than the tinned foods, which should be kept for emergencies and given away at the end of the trip. The great weakness of the Caucasian commissariat is in the all-important item of bread. Away from the towns this is invariably very bad. It is made of maize or wheat flour mixed with rye, or of rye alone ; no yeast or baking powder is used, and it is never properly cooked. Naturally it is exceedingly trying to a western stomach. When forced to use it, one should have it well toasted. Very good bread can be bought in the towns, and as large a supply of this as possible should be taken. There is also an excellent form of bread to be got in some of the small *dukhans* or shops up country. It is in hard glazed small rings, and is threaded on strings and hung up like onions to the roof. It keeps well, and is quite palatable and digestible. One way of overcoming the bread difficulty would be to engage a cook-interpreter, who could bake, and to carry flour and a small portable oven with the party.

Organization.

Interpreter-couriers are to be found at Tiflis and Vladikavkaz. These, however, would not care to attach themselves to a climbing party, or, in fact, to leave the roads at all ; walking for even a few miles is not in their line. There are guides and tariffs—fairly reasonable—for both Kasbek and Elbrus. Good material undoubtedly exists for the development of a school of real mountain guides, but their time is not yet. A climbing party must bring its own guides, or, better still, have some one in the party who, by previous experience or knowledge of guideless climbing in the Alps, is qualified to act as guide and leader on high ascents.

After bread and horses, porters are the principal worry for the leader of a party in the Caucasus. The mountain tribes are independent and 'huffy,' and great tact and patience are needed in dealing with these semi-civilized children of nature. The men are not, like the Swiss, accustomed to carry heavy burdens, and are quite ready to throw up their job and throw down their loads at or without a moment's notice.

The cook is a very important member of the party. He stands for creature comforts, and the party is fortunate which succeeds in engaging a capable man at the town from which the expedition starts. It is very necessary for all purposes that one at least of the party should know some Russian. The cook-interpreter, if only one man is engaged, must speak, besides Russian, at least one western European language, and he must have a good knowledge of as many of the Caucasian languages as possible.

Maps.

The general map of the country is that known as the 5-verst map, which is to be obtained in Tiflis or from the principal London map-sellers. It is on the scale of 5 versts = $3\frac{1}{3}$ miles = 1 in 210,000, to the inch. This, though quite accurate as far as the low country is concerned, is of little use in the mountains. The best known map is that issued with Messrs. Freshfield & Sellas's *The Exploration of the Caucasus* (Edward Arnold, London, 1896). It is on the 5-verst scale, and is a useful general map, though the scale is too small to show the mountains properly.

Herr Merzbacher issued with his weighty work, *Aus den Hochregionen des Kaukasus* (Leipzig, 1901), a very convenient map on the scale of $3\frac{1}{3}$ versts = 1 in 140,000. This map is to be obtained from the publishers. It endeavours to give more names, heights and details of mountains than Mr. Freshfield's; but this, in some cases, has led to a multiplication of errors. Mountains have been inserted which explorers of the locality have failed to find, and in the south-eastern portion of the central group the nomenclature and heights given are often very misleading. By far the most useful map, and the map which is practically indispensable for the mountain explorer who is not prepared to make his own, is the Russian 1-verst map. This is on a large scale ($\frac{1}{42000}$). It gives with very

considerable accuracy the forms of such glaciers and mountains as are visible from positions reasonably accessible to the surveyors. It seldom commits itself by giving any names at all to the peaks, except to the principal ones—although the more important glaciers are generally named. The printing of the names and figures—of course in Russian characters—is often exceedingly bad. The maps are on the hâchure system. With the exception of the sheet covering Kasbek, which is on sale at Vladikavkaz, they can only be obtained through the military authorities in Tiflis.

Expense.

This will, of course, greatly depend upon the style in which the expedition is conducted. If a courier-interpreter is engaged, and Swiss guides are brought, the expense must be expected to be considerable. In spite of the general rise in the cost of living and in the price of labour, which of late years has increased in the Caucasus—between 50 and a 100 per cent—an eight or nine weeks' journey out from London and back can be done comfortably at a cost not exceeding £100 for each member of a party of four, five or six. Below are given a few prices, based on the experience of the expeditions made in the years 1904, 1911 and 1913. They are, of course, only approximate. Foodstuffs will be found not to vary so much in cost as the hire of horses and porters.

	1904.	1911.	1913.
Horse, per day . .	1–3 R.	1½–2 R.	3–4 R.
Porter, per day . .	—	1 R.	1½–4 R.
Sheep (small) . .	4–6 R.	—	3–5 R.
Hens (small) . .	20–40 K.	—	35–50 K.
Eggs (small) . . .	1–2 K.	—	1½–2 K.
Bread (about 2 lb.) .	8 K.	—	10 K.
Cheese	15 K.	—	10–20 K.
Wine(Kakhetinskoe),litre	—	—	1 R.
Beer	—	—	15–20 K.
Sucking-pig (very small)	2–3 R.	—	2 R.

Rouble=2s. 1½d.
Kopeck=¼d.

Note.—All prices given are pre-war.

CHAPTER XIV

THE MOUNTAINS OF CORSICA

BY GEORGE FINCH

THE best time of the year for climbing in Corsica is the spring. The weather is fine during the months of April, May, June and July; but in the latter half of June and in July the midday heat is often oppressive. This is seldom the case in April or May.

Season. During these two months the melting snows ensure a supply of water, which is often deficient in the hot summer months. In April, also, the snow-line is still very low; from the mountaineer's point of view this is an advantage, as the approach to the climbs often lies over long slopes covered with dense undergrowth, known as 'maquis,' and most troublesome for walking when not snow-covered. As early as towards the end of March the steeper rocks are already sufficiently free from snow for climbing, while the snow on the gentler slopes remains to facilitate the crossing of the 'maquis.'

Another point in favour of an early season is the greater clearness of the atmosphere. In March and April of 1909 from every summit we had a clear view of the Apennines and of the Maritime Alps even late in the day. In the summer months mists rising from the Mediterranean partially obscure the view shortly after sunrise.

A light tent and sleeping-bags should be taken, as the nights are often cold. A primus oil-stove (petroleum

Equipment. used to be obtained almost anywhere, but methylated spirits were difficult to procure), and tinned milk, meats, vegetables, fruit and jam must all be imported, as they are not procurable in Corsica. Such provisions are dutiable, but my personal experience has been that the Customs are indulgent if informed of the mountaineering object.

For porterage, mules can be procured. One mule will carry 250 lb., and costs, together with the services of the mule-driver, according to the locality, from four to eight francs a day.

Both driver and mule entertain a dislike to snow, and will shy at the prospect of crossing even the most diminutive snow-patches. Otherwise they will go almost anywhere. I have covered as much as 38 miles of road, scrub and mountain-track in a day with one mule carrying rather over 200 lb.

The character of the usual hotel accommodation in the interior will be found to bias the climber in favour of camping out. He can thus also move at once nearer to the base of his climbs. Wood for fires is plentiful, and many streams provide trout-fishing (three to the pound).[1]

The two most important mountain groups are those of the Rotondo and the Cinto.

Centres, Modes of Access, and Topography.

The garrison town of Corte will act as a centre to both these districts. It is reached by a four hours' rail journey from either Bastia or Ajaccio.

A steamship service connects Bastia with Leghorn three times a week (five hours' crossing). Fairly frequent services likewise connect Ajaccio with Nice (twelve hours) and with Marseilles (sixteen hours). The approach to Corsica by all three routes is magnificent, especially that of Nice to Ajaccio. It is well worth while to make this crossing by a day service.

From Corte a good camping centre at the head of the Restonica valley, in the heart of the Rotondo group, can be reached in four hours (mule-track most of the way).

The true centre of the Cinto group is Calacuccia. This village can be reached from Corte in six hours, walking over the Col de la Rinella; but there is no mule-track. The view from this Col embraces practi-

[1] From the point of view of expense, the mountaineer will find mountaineering in Corsica exceptionally cheap. Hotel prices average five to six francs per diem, but the climber who spends most of his time in tents will incur even this moderate expense only for comparatively brief periods. The return fare to Ajaccio is about £8, and, provided the climber imports his own stock of tinned provisions, a further sum of £15 to £20 should be more than ample for a month's sojourn in the island, on a pre-war estimate.

cally the whole Cinto group. An alternative route, advisable when it is necessary to transport baggage, is from Corte to Francardo (half an hour's rail), and thence in three hours by carriage (postal service, or hired conveyance, 15 francs) to Calacuccia. Convenient camping centres in the Rodda, Erco, Viro and Golo valleys can thence be reached in from three to five hours.

For the northern slopes of the Cinto group Asco is the best centre (three hours by road from the railway station, Ponte Leggia). This village also serves as a base for the magnificent chain of mountains running eastwards from Monte Padro (2400 metres) to Monte Corona (2143 metres), and thence in a southerly direction to Punta Minuta (2547 metres) in the Cinto group. To the north of Monte Padro lies the Tartagine valley, at the head of which is the Capo al Dente (2032 metres), one of the most sporting peaks in the island. A number of unclimbed peaks close in the valley to the north. The approach to the Tartagine valley is rather troublesome. From Palasca (on the Bastia-Calvi railway line) via Mausoléo to the *maison forestière*, the best centre, takes eight to ten hours by a good road.

Other groups offering good climbing and an abundance of 'first ascents' and 'new routes' are the Monte d'Oro and Monte Renoso groups. Vizzavona, the centre for both these ranges, boasts of good hotel accommodation, and can be reached in three hours by rail from Ajaccio and in one hour from Corte.

The above-mentioned mountain groups are those which will attract the climber most of all. They offer almost endless possibilities for first-rate climbing over both known and virgin ground. With the exception of Monte Renosa, the main mountain groups lie to the east of the Ajaccio-Bastia railway, and for this reason most climbers prefer to approach the mountains from the east, from Corte, the half-way station on the line. There is, however, little to choose between the eastern and western slopes—both offer high-class climbing, and preference might now well be given to the western slopes, as here much more remains to be accomplished in the way of pioneer work. As a general rule, camp centres for climbing on the western slopes of the d'Oro, Rotondo, Cinto and Corona groups are best

reached by crossing the main chains from Corte. In these cases the mountaineer will have to act as his own beast of burden unless the route be *entirely* free from snow, which is very unlikely in the spring.

There are a great number of mountain groups either of minor importance or difficult of access (the Incudine, 2136 metres; Punta di Capella, 2044; etc.), but as a rule from the climbing point of view they are of little interest. Mention should be made of the chain of hills, attaining heights of over 1300 metres, which forms the backbone of the promontory of Cap Corse. The main ridge can be traversed throughout its length in one long day from Bastia, and the splendour of the views down on to the Mediterranean and towards the ranges of the interior is beyond all description.[1]

Nature of the Climbing.

There are no glaciers in Corsica, though in the Cinto and Rotondo groups snow-patches occasionally survive the summer's heat. Both these groups show marked traces of glacier action. The ice work is limited to cutting in ice-choked chimneys and to clearing rocks. Long, steep, hard-frozen snow slopes necessitating a sustained use of the axe are seldom encountered, and ice-claws may safely be dispensed with. On the other hand, ski might prove to be of great value, as the return on foot from a climb over the long slopes of soft snow lying on the 'maquis' is often very trying. Devotees of skiing will find plenty of splendid ground, especially on the eastern and southern slopes of the Cinto group.

The rock is sound, and handholds are only too abundant. As a general rule, only those climbs are difficult which lead up over apparently perpendicular rock walls or ridges, rocks which from the distance look hopelessly impossible.

This deceptive appearance may account for the fact

[1] When one considers the proximity of the mountains to the coast, their height (Monte Cinto, 2710 metres) is considerable; and many magnificent walls of well over 2000 or even 3000 feet are to be met with.

Joanne's guide-book, *La Corse* (Hachette et Cie, Paris), and *Baedeker*, contain very full information as regards accommodation, etc. *Baedeker* supplies much useful information on the mountains themselves. The best maps are those of the Corps d'État-Major, on a scale of 1 to 80,000. They are somewhat unreliable, and the reverse of clear. These and other maps are procurable at the stationers' shops in Ajaccio and Bastia.

that until 1909 no climb of exceptional difficulty was accomplished in the island. Paglia Orba (2500 metres), the Matterhorn of Corsica and the most conspicuous mountain of the Cinto group, may be taken as an instance.

The east wall was first climbed in the spring of 1909. The final 1000 feet of this wall appear to overhang, and actually do so for considerable sections of the ascent. The unique character of this climb would alone justify a visit to the island. The possibilities of new climbs—both new routes and first ascents—are still numerous. Nothing need be declared impossible on the strength of an inspection from a distance; the chances are that a route of the most hopeless appearance will 'go,' and also provide the best of climbing.

The view from almost any summit embraces greater or lesser portions of the sunny coast-line, which adds the charm of contrast to the alpine surroundings.

CHAPTER XV

THE HIMALAYA

BY T. G. LONGSTAFF

ALTHOUGH the natural and physical conditions in those ranges loosely called the Himalaya are probably more diverse than in any other mountain region in the world, still a certain amount of generalization is possible.

General Considerations

Configuration.

Essentially, we find two more or less parallel ranges. The southern and highest is visible from the plains. On this stand the great peaks whose names are familiar to us. This outer range is pierced by numerous rivers which burst through a series of deep, narrow gorges. The low elevation of these river valleys brings an almost tropical fauna and flora up to the foot of the Snows. The snowline on this range, owing to greater precipitation, reaches down lower than on the second range, that to the north. This second, or northern, range constitutes the local water-parting between India and the countries to the north. It is reached by broad, open, treeless valleys almost Tibetan in character as in fauna. Its snowline is high owing to the drier climate. The peaks seldom attain 25,000 feet, and, in general, are not so precipitous as the great line of peaks to the south.

Even in Kashmir this arrangement of two parallel ranges may be traced; but though there is plenty of fine climbing on the ranges which enclose between them the Vale of Kashmir, most of which have already fallen to the attacks of residents and British officers, yet the eyes of the mountaineer from England will be fixed on the vast range of the Karakoram beyond the Indus.

THE HIMALAYA [C. F. MEADE

This grand chain has a character of its own, though there are points of resemblance to both ranges of the Himalaya. The glaciers are the largest outside the Polar regions. The peaks are very high and very precipitous. It is the country *par excellence* for the mountain explorer; but for the mountain climber the greatest drawback is the journey of four to six weeks from England to the scene of operations.

Climbing Conditions.

Rock climbing is the same all the world over in that the conditions vary on every mountain in any range. Also, a rock peak cannot be really reconnoitred from a distance; we must come to grips with the rocks before we can know the practicability of a route. As to snow and ice, I think conditions are worse in the Himalaya than in the Alps or Caucasus, chiefly owing to greater variations of temperature. Avalanches of all kinds are bigger, and great caution must be exercised in the choice of camps and bivouacs. Snow and ice slopes in the Alps appear to me to look steeper than they eventually turn out to be. In the Caucasus they are about as steep as they look. In the Himalaya I have usually found them markedly steeper than their distant appearance led me to expect.

Management.

Diverse as are the physical conditions of the Himalayan regions, the inhabitants thereof show an even greater variety of character. Some general rules of conduct may, however, be indicated, though most of them may be considered by mountaineers as truisms not worth the stating. The first object to keep in view is to create such an impression amongst the natives as will make the path of subsequent visitors easier and not harder. Almost all hill men are superstitious. You must expect timidity at first. Remember particularly that native servants are very prone to abuse the authority which in the eyes of the villagers is acquired by the mere fact of their being in your service. The hill man is usually inarticulate; he knows you cannot speak his dialect, and probably your servants are the only interpreters. Your watchfulness is his only chance of a square deal. Pay for *everything* with your own hand, if it be only an anna for a few eggs. Of course always pay your day-to-day coolies yourself, and, if they desire it, give each his four or eight annas

separately, only paying over a whole rupee to a group from the same hamlet.

Religious beliefs are very mixed in the hills, and it is a good rule to keep well away when your coolies, whatever their race, are cooking or eating. Of course you must never offer them cooked food. Away from the villages, and if only two or three men are with you, such things as biscuits and jam—being assumed not to be made by hand—may be offered if necessary. This applies more especially to Hindus; but though Moslems should eat with Christians, the same rules had better be applied. With Gurkhas (though nominal Hindus) or others with the strain of Mongolian blood in them—who are or have till lately been Buddhists—the code need not be quite so strict.

These remarks might seem unnecessary to anyone having experience only of sport or travel in High Asia; but for the mountaineer who essays to take coolies or shikaris to high bivouacs it is obviously of great advantage to get them to adopt European foods and methods of cooking. This was successfully done by the Italian expedition to the Karakoram in 1909. Tea (native green is best) and the vilest cigarettes may be offered to any coolie without fear of offence as a reward after an extra hard day. The gift of a sheep or goat on suitable occasions produces a glow of contentment all through the camp.

As to more general conduct: Refrain from whistling. Do not bathe naked before natives. Never lose your temper except on purpose and with a definite object. Never allow your servants to be familiar or to enter your tent with their shoes on. Do not laugh or joke with your men unless you are master of the language. If you do, you may be as broad as possible, especially with Gurkhas. Exact proper respect from all village officials with whom you come in contact. Conversely, treat a native gentleman with the same courtesy that you expect yourself. Hindu religious mendicants and devotees are easily irritated, and are best left severely alone.

It is absolutely essential that the climber planning a visit to the Himalaya should make up his mind exactly what he wants to do. Leaving aside exploration, the most dangerous lure on the path of the

mountaineer, we may for convenience confine ourselves to two courses—the attack on some particular and probably very high peak; or a less ambitious and more general campaign in some selected district in which climbing for its own sake, apart from any design of raising 'the record,' is the object aimed at.

The Campaign.

Having settled the strategic idea, we must next consider tactics. In the case of a single big mountain, the method of attack will be in the nature of siege operations; and in this case a siege train, in the form of Piedmontese guides, makes for success. Still, a siege is dull, and to get the full pleasure out of a trip in the Himalaya, amateurs and not guides are the best companions. The difficulty is to get them for an absence of several months from England.

As a matter of tactics, the writer prefers, with or without guides, to try and 'rush' peaks; for by this means far the most climbing is secured. On the other hand, more frequent failure is risked by such direct attacks. Unless the weather is favourable, a successful high ascent is quite impossible; and if a climber is moving about and continually attacking different peaks, he loses chances on particular peaks which the besieger, waiting upon their favourable moments, can take instant advantage of.

There is, further, the vexed question of the actual final assault. Should it be a gradual pushing of bivouacs higher and higher, in the hope of acclimatizing ourselves to the want of oxygen; or should we make the last bivouac as low down as possible, in the hope that better conditions for digestion and sleep will enable us to put forth one tremendous effort on the final day of the adventure? Subjection to low pressures, or want of oxygen, for days or weeks will find out our weakest spots. With some the belly, with others the mind. For myself, I know that after several nights at very high altitudes my mind is dull and my courage reduced to vanishing-point. In all cases, so far as I know, there is considerable loss of weight. To actual mountain sickness we can acclimatize ourselves by going as frequently as possible above 20,000 feet. But we cannot stay for long at very high altitudes and preserve all our strength. We must come down again soon to

15,000 feet, or lower if we can. It is easier to deny than to prove the existence of mountain sickness; but although we do not bleed from the ears, or even the nose, nowadays, most of us suffer some diminution of our powers. This being so, it appears that the best chance of success on a very high mountain is to send *some one else* to examine the final route and to lay the last bivouac for the storming party; just high enough for them, supposing they are in good condition, to reach the summit well on in the following afternoon. This may seem a soulless way to wear a mountain down; but it is merely the application of Polar methods to slightly changed conditions.

As in the Polar regions, also, the weather decides between success and failure, between return and no return. Because of the cold, it is unwise to start before sunrise.[1] The risk is less in descending easy ground at night—perhaps because movement is then quicker.

A concrete example puts the case shortly. Trisul is only some 23,400 feet high, but it appears to be the highest peak of which the complete ascent is universally admitted. After two nights, at about 20,000 feet, in bad weather, the party retreated to 14,000 feet. Three days later, after one bivouac at about 18,000 feet, the summit was reached at 4 p.m. (10 hours), and the night was spent on the return at about 16,500 feet.

Season.

Generally speaking, the regular rainy season ('monsoon') commences in July and ends in September; but all the world over more rain falls, and falls more frequently, on mountains than on the country immediately surrounding them. Hence, though probably June is the best month for the high peaks, we cannot even then count on continuous fine weather.

It is always easy to avoid the monsoon by pushing north into the second range; but here again it must not be expected that the highest peaks will completely conform to the rainless character of the rest of this region.

When the rains are over, in September and October spells of gloriously fine and clear weather are the rule; but the nights are then bitterly cold above the tree-line.

[1] *Alpine Journal*, vol. xxiii. p. 223.

The Chief Districts

Though the Himalaya, in the widest sense of the term, extend beyond the Brahmapootra on the east and beyond the Indus on the west, we may impose these limits upon them for present purposes. Furthermore, only sections of these ranges are at present politically accessible to the mountaineer.

Practically the whole of the Himalayan region is covered by the Great Trigonometrical Survey of India on a scale of one inch to four miles. The sheets are obtainable in London.

It would be easy to criticize this map in detail. For reasons of finance and policy, the surveyors were ordered to cover a very large area each season and not to attempt detailed surveys of uninhabited areas. It would be, therefore, manifestly unfair to set up claims which were never made by the authors and then to demolish them.[1]

The Eastern Himalaya.

For Bhutan, it is best to consult Claude White's *Sikkim and Bhutan* (Arnold, 1909). It would be necessary to obtain special leave from the Government of India to travel here; and the country is not very promising from our point of view.

Sikkim.

For Sikkim, consult Mr. Freshfield's *Round Kangchenjunga*, and several papers by Dr. Kellas in the *Alpine* and *Geographical Journals*.

Sikkim is a region of tropical contrasts, merging on the north into Tibetan conditions. The vegetation is magnificent. The great peaks in the south are difficult; in the north much easier, where the isolated peak of Chumolhari (23,930 feet) has long challenged attention.

The starting-point is Darjeeling, reached by rail in a day and night from Calcutta, or in three days from Bombay. A call should be made on the Deputy Commissioner, especially if the climber intends to enter native Sikkim. At present permission would not be given to enter Nepal or Tibet, and probably not for Bhutan. Stores can be bought beforehand at Darjeeling, and a Buddhist cook should be, if possible, secured.

The semi-Tibetan natives of Upper Sikkim, and similar immigrants from north-eastern Nepal, are splen-

[1] *Alpine Journal*, vol. xxv. p. 389.

did material for glacier work. Dr. Kellas with these people found himself quite able to dispense with alpine guides. They are cheerful, smiling and easy for Europeans to get on with, fond of a joke, and, if handled well, honest and reliable. For the first part of the journey in the lower country temporary coolies can well be used.

Nepal.

In Nepal, though in certain circumstances the frontier is not inviolable, yet for a variety of reasons, not all political, an Englishman is not likely to be able to penetrate to any of the great peaks. At the same time, for the mountaineer as well as for the explorer, few journeys are better worth making than that up the valley of the Gandak, or the Kosi, into the heart of the grandest of all mountain ranges.

Kumaon and Garhwal.

To my mind this is the finest part of the Himalaya at present accessible. It is the most 'alpine' portion of the Himalaya, possessing peaks over 25,000 feet. The scenery, flora and fauna are exceedingly beautiful and varied. It contains much difficult ground, even below the tree-line. Most of the highest peaks are very severe. Towards Tibet the country opens out and the mountains are easier.[1]

The approach is by rail to Kathgodam. There follows a short drive to Naini Tal, where all ordinary supplies may be obtained. Thence a driving road to Ranikhet and a pony road to Almora, where fair supplies are also obtainable.

A formal permit must be obtained from the Deputy Commissioner of Almora, and two chuprassis will be told off to engage coolies from village to village. For Garhwal it will probably be necessary to get a separate permit and chuprassis from the Deputy Commissioner at Pawri.

When the base of operations is reached in Garhwal or Kumaon, it is advisable to engage a few local men as permanent coolies. The ordinary stages are worked by relays of coolies from village to village. In these, native flour (*ata*), rice, fowls, goats and, higher up, sheep can usually be obtained. A Mussulman cook can be obtained in Naini Tal. An army reservist—Garhwali or Gurkha—would be found of assistance. He should be provided with an extra broad pair of good nailed boots.

Gurla Mandhata (25,350 feet) is just over the frontier

[1] Consult A. L. Mumm's *Five Months in the Himalaya* (Arnold).

in Tibet. Access to it is at present barred by our own Government. It can be reached through Kumaon in a fortnight from Almora, and is probably easily climbable from the Gurla Glacier.[1]

In Garhwal the Rishi Nali with Nanda Devi (25,660 feet) is the centre of attraction.[2] Under present conditions it is not likely to be climbed.

Dunagiri (23,184 feet), an outlier of this group, is pretty certainly climbable by Graham's route—the south-west ridge—from a bivouac at the head of the Tolma valley. Farther north, Kamet (25,443 feet), allied with bad weather, has so far defied repeated attacks.

Every variety of climbing is to be found on these mountains, and it is a region that seems to exert an extraordinary fascination on every one who has visited it.

In the matter of securing coolies for climbing purposes, it is well to remember that the Kumaonis are a poor lot; the Danpurias and Garhwalis are better; the partially Hinduized Bhotias of Badrinath Niti and Milam are good; the still more Mongolian people of Gharbyang, and of the north-west corner of Nepal, are splendid, and can be taken on into Tibet.

Tehri Garhwal.

This small native hill state, west of British Garhwal, contains some very fine peaks around Gangotri. It is reached from Lansdowne or Mussoori. To facilitate travel, an introduction should be obtained to the Rajah. The mountains present a most promising and practically untouched field for the mountaineer. As coolies, the local men in the north are probably pretty good.

The Simla Hill States.

Kangra, Kulu, Spiti, Lahaol and Bushahr embrace a very large mountain area, and offer unlimited scope to the less ambitious mountaineer. It is an 'alpine' region, but still on the Himalayan scale. The peaks rarely attain 23,000 feet. But probably more actual climbing can be obtained in one season here than in any other section of the Himalaya. General Bruce's book, *Kulu and Lahoul*, should be consulted.

The entry is from Dharmsala or Simla. The latter, probably, will be easiest for new-comers to India, since

[1] *Alpine Journal*, vol. xxiii. p. 217 *et seq.*, and map.

[2] Consult *Alpine Journal*, vol. xxiii. p. 202, and maps, and vol. xxiv. p. 107, and map.

there is a railway to Simla; and at Simla supplies and servants can be obtained.

Hindus, Buddhists, and nominal Moslems are met with, and for coolies, it would seem that the quality of the natives improves as we move north.

Chamba is a semi-independent hill state. The arrangements for travelling must be made with the Rajah. It is a difficult country, and not very promising. Manimais (or Mani Mahais), however, looks magnificent.

The mountaineering literature on the Karakoram is voluminous, and it would be out of place to enter into details. A drawback to this region is the time it takes to reach the mountains. The railway runs to Rawal Pindi; thence by carriage or motor to Srinagar, two to ten days, according to the state of the road. From there it is a matter of coolie or pony transport, according to the time of year and the route chosen. The time taken from Srinagar to Astor (for the Nanga Parbat group) will be again about ten days; or from Srinagar to Skardu (for the western Karakoram) about a fortnight. From Srinagar to Leh takes about three weeks. The routes themselves vary considerably according to the time of year.

Kashmir and Karakoram.

It may be remarked that there is a very promising 25,000-foot group, which can be easily reached from Panamik in the Upper Nubra Valley.[1] Unfortunately, our party was prevented by bad weather from making anything like a thorough reconnaissance. It would probably take two months to reach the foot of the peak from England.

The Kashmiris (mainly Moslems) on the whole are a poor lot, and as servants and followers they are apt to ill-treat and rob the up-country villagers. But both Baltis (Moslems) and Ladakhis (Buddhists) are splendid as coolies if they are handled properly.

With regard to the Gilgit Agency, of which the native states of Hunza and Nagar form part, it must be borne in mind that permission to travel is difficult to obtain. The country is poor, and transport and supplies are hardly sufficient for the use of the garrison and the frontier officers, who have to be constantly on tour.

The Hindu Khush, etc.

[1] *Alpine Journal*, vol. xxv. p. 487, with map, and Neve's *Picturesque Kashmir*, chap. xii.

The seven distinct tribes inhabiting the Agency vary in quality from the point of view of the mountaineer. Most of the shikaris are splendid cragsmen, and some of the Hunza men are acquainted with axe and rope.

The Hindu Khush, extending from Hunza through Ishkoman, Punyal, Yasin, Ghizr and Chitral to the Afghan border, contains many, almost untouched, fine mountains and glaciers, culminating in the wonderful group of Tirich Mir (25,426 feet). But the conditions of transport and frontier policy will render access difficult for some years to come. Yet the region is a most interesting one and the scenery very varied, for it includes the water-parting between the Indus and the Oxus. Many aspects of the country, both physical and human, vividly recalled to me memories of the Caucasus.

Personal Matters

Expense.

The cost of a climbing expedition in the Himalaya entirely depends on the scale of preparation. If guides are taken, their fares, outfit and pay will be a heavy item—not less than £250 each. It is obvious that the further English stores have to be transported the more they will cost by the time the mountains are reached. It is cheaper in the end to get most of the stores at the last hill station, and to pay a little more for them. The equipment for the high bivouacs, however, must be brought out from home. This will cost, say £50. A first-class return by P. & O., plus fare to the end of the railway transport, may be put at £100.

If the expedition is on a modest scale, and the climber has some knowledge of the language and customs of the country, and can limit himself and his servants to a dozen loads, the actual expense of travel in the hills is not great. Twenty pounds a month is a liberal estimate for each European. This includes everything: food, servants and coolies' wages. Two amateurs, contributing £500 in all between them, and with four months to spare, ought to be able to put in ten weeks in the hills without any difficulty. In Kashmir, with the same allowance of time and money, they would only get eight or nine weeks in the mountains, and in the Karakoram not more than a month. (All estimates are pre-war.)

Obviously a big expedition with guides must cost a great deal more than this, but the amount can be calculated on the basis of the figures given above. For a large party it would be advisable to bring out all the supplies for the mountains packed in numbered Vanesta cases. A number must be put *on every side* of each package, and lists of contents to correspond prepared. These cases also serve as good substitutes for chairs and tables.

Outfit.

The days or weeks of travel to the foot of the Snows require an outfit distinct from that required for high mountaineering. The extent of the travelling outfit depends primarily upon the time and money at the disposal of the individual. A camp-bed and an 80-lb. Kabul tent, ordered beforehand from the Elgin Mills at Cawnpore or through the A. & N. Stores at Bombay, is worth serious consideration. Personally, I prefer a Whymper tent, with an extra fly to keep the sun off and with the floor-cloth sewn in. A Whymper tent can also be used by the cook and followers, without the double fly and with a loose floor-cloth; if this is sewn in, it is apt to get burned when fires are lighted inside the tent on wet evenings.

On all railway journeys, in most bungalows—public and private—and even in some hotels, bedding must be carried. A very thin cork or hair mattress is a luxury; the sleeping-bag does nearly as well. Two Jaeger sheets, two Jaeger blankets, a pillow and a couple of pillow-cases, aided by a bath towel, really suffice. The whole is wrapped up and strapped in a strong ground sheet laced down the middle, or in a more complicated valise sold in India. This bundle constitutes the *bistra*, one coolie-load; it should be as rain- and vermin-proof as possible.

A folding X-table and chair are almost necessary concessions to caste. A spare chair should be available if natives of chair rank are likely to be met. An india-rubber or canvas bath is also necessary for other purposes. When bathing in the open, as before said, drawers at least should always be worn out of respect for native sentiment. Toilet kit is carried in an enamelled iron basin with a leather cover, called a *chilamchi*.

Cooking vessels (*degchis*) should be of aluminium, but cups and plates and teapot may be enamel-ware.

Either hurricane lanterns (kerosene), or candle-lanterns that can stand on a table, are necessary in camp. All these should be obtained from the A. & N. or other stores in India.

Food.

As to food, the necessary tinned butter, biscuits, jam and other groceries can be bought at the last hill station. In most places in the hills sheep or goats can be bought as required. Farther on you must bring your own live stock along with you; this should ensure milk of sorts. Chickens and eggs, rice and native flour (*ata*), can be purchased in most villages.

On the glaciers, cocoa, chocolate or tea, with plasmon, are needed for breakfast, and, for the evening, maggi (vegetable) soups with rice. At the highest camps by far the best drink is some sort of dried malted milk preparation, like Horlick's or Allen & Hanbury's diet. The above must be brought out from England, unless it is found to be obtainable from the A. & N. Stores in Bombay.

The High Camp Outfit.

The tent should be the Mummery pattern if carried by yourself, but may be Whymper pattern if coolies are still available. Ice-axes can be lengthened to serve as tent poles, if desired, by means of a piece of hollow bamboo 10 or 12 inches long which is slipped over the point. The bamboo must be bound round with wire at the end to prevent splitting. In bad weather a small ventilator to the tent is necessary, as it may be found impossible to open the door. Sleeping-bags can be made of any thickness and warmth of goose-down. Balloon-silk should be sewn underneath the bag, and brought up for at least 18 inches over the feet. At high altitudes only a primus stove, burning kerosene, will serve. Absolute alcohol should be carried to start the apparatus, and a flat strip of perforated brass as a wind-shield is necessary. The primus stove and reserve of kerosene, in old petrol tins, must not be carried in the same load with any food. This must be specially remembered during the *whole* of the expedition.

It is a good plan to camp not later than 3 p.m., and to start melting snow at once. The first melting will probably be drunk tepid. Then the evening meal, or rather drink, of soup or cocoa or malted milk must

be taken; following this, while the stove is still alive, more snow should be melted and the morning's drink prepared. If this is placed in large thermos-bottles inside the sleeping-bags it will last, if untouched, till the following afternoon.

It is worse than useless to invite frost-bite by a very early start. But in any case the time cannot be spared to melt snow in the morning.

Clothing.

So long as you wear a good 'Cawnpore' pith helmet (*topi*) nothing else matters much. Sunburn will prevent you wearing too little. Some people prefer a turban. This consists of the *pugari* or *loonghi* and the *koolla* or conical cap affected by Mohammedans and Europeans, and round which the pugaree is worn. On a cold morning the tail of the pugaree can be wrapped round the neck. It is easy to tie—in a fashion. It is in some ways better than a pith helmet, but does not protect the eyes from glare. Shorts are very cool for marching; but beware of blisters at the back of the knees. A spine pad is necessary in the valleys, and pleasant at even the greatest altitudes.

Footgear for high climbing is still a vexed problem. You must have very heavily nailed boots for the moraines. On snow I have worn a covering of raw cowhide, *hair outside* over the front half of the boot. The half sole is made of stoutest canvas. The whole may be garnished with a common pair of Swiss ice-claws. Boots should be large enough for two pairs of socks to be worn. Since putties will be invariably used, stockings will only be needed for a change in the evening. No doubt for very high work some Polar footgear would be better than climbing boots.[1] Possibly ski-boots may meet the difficulty. But a piece of blanket wrapped over the whole boot and held in place with a large pair of claws, or by the boot-nails as they wear through, ought to be an efficient substitute. Swiss snow-shoes are hardly worth carrying, but on easy slopes at high altitudes they can be very useful, and I have been glad of them. Ski are probably useless, for our purpose, owing to transport difficulties.

Smoked glasses are only better than nothing; the proper colour is something between yellow and green, such as Sinclair's 'N.W.V' glasses, or their like.

[1] Consult *Appalachia*, Oct. 1914, vol. xiii. p. 160.

You cannot produce a good map without sacrificing much time and energy. But apart from this, it is useful to know the heights of camps, etc. For this purpose use at your camps a boiling-point thermometer (hypsometer), specially constructed for high altitudes: you must observe the air temperature with a swing thermometer at the same time.

Instruments.

Also take a large (4½ inch) Watkin mountain aneroid (J. Hicks, Hatton Garden), graduated from 31 to 10 inches. Keep it permanently out of action as soon as you go above 5000 feet, and only throw it into gear when taking a reading—allowing not more than a few minutes for it to settle. Put it out of gear as soon as the reading has been made.

A reading should be taken with the Watkin whenever the hypsometer is used, as a check on both instruments. When climbing, and at the highest camp, probably only the Watkin will be used, since, even with absolute alcohol, an hour may be spent over an hypsometer observation at great heights. The Watkin must be read both on leaving camp and on returning.

The air temperature ought to be taken at each observation; but this is a refinement.

All observations must be immediately entered in a special notebook with hour, date and place. These should be worked out by some one else on a return to civilization. The Indian Meteorological Department or the Survey at Dehra Dun or the Royal Geographical Society would be the natural referees.

CHAPTER XVI

THE MOUNTAINS OF NORWAY

BY W. CECIL SLINGSBY

CONCERNING the mountains of Norway, their geography and the history of their exploration, a considerable amount of published information is already available for mountaineers: it is, therefore, unnecessary to do more than give a general idea of the mountaineering potentialities of the country, and of the facilities of travel and provisioning.

Guide-books and Literature.

Baedeker is excellent as a general guide, and a copy should be in the hands, and to some extent also in the head, of at least one member of every mountaineering party. In addition, maps should be obtained of each district which the climbers intend to visit. The Amts Karter, price 1 *krone* each, will answer this purpose.

There are no 'Climbers' Guides' for Norway, though many books deal more or less with its mountains. The great mountain classic is *Norway and its Glaciers*, by Professor J. D. Forbes. Mrs. Aubrey le Blond has dealt solely with one group, the mountains of Lyngen Fjord, in *Mountaineering in the Land of the Midnight Sun*. This is of use to those who wish to climb between lat. 69° and 70°, but is not of service in Central Norway. *New Climbs in Norway*, by Mr. E. C. Oppenheim, deals also with certain individual peaks. There is an excellent book in Norsk on the Söndmöre Alps, near Aalesund. *Norway, the Northern Playground*, is the result of many years' experience on my own part, but barely touches the romantic regions of Arctic Norway. The *Alpine Journal* has many papers by many authors on all parts of the country.

Of late years Norsk mountaineers have been very

NORWEGIAN PEAKS [NORMAN COLLIE

active, not only in Norway and in the Alps, but also in far-off Himalaya and the Southern Andes. The *Aarbog* of "Den Norske Turist Forening" virtually resembles an alpine journal, and its illustrations of glaciers and aiguilles are valuable. It has had for many years mountaineering papers both in English and Norsk. Every one who intends to climb in Norway should become a member of this most useful club. He will have considerable privileges, connected with mountain huts, etc. No mountaineering qualification is required; merely a small subscription. T. Bennett & Sons, or F. Beyer (Tourist Agents at Bergen), as well as the keepers of the tourist huts, will enrol members. There is also an inner circle, the "Norske Tinder Klub," whose mountaineering qualification is at least as high as that of the Alpine Club.

A slight knowledge of the language is essential. Norsk is easier for north-country folk to acquire than for southerners, as much of our northern dialect is almost identical with Norsk. As an outcome of perhaps laudable ultra-patriotism, great changes, which in the main lead to a simplification of the language, are being made. The natives themselves during this period of transition apparently have no fixed rules of spelling, and a foreigner need not feel uneasy on the subject. The greatest difficulty in connection with this phase is that—so far as I am aware—there is no Norsk-English dictionary which has adopted, or at present *can* adopt, the spelling mostly in use.

Season.

As in Switzerland, July and August are the best months for mountaineering in Norway, though, speaking generally, there is more often settled weather in June and September. In some years, the two last weeks in June are perfect for climbing, but as in the Alps again, there is often too much snow for pleasant mountaineering before July. Similarly, there is often ideal weather in September, and though the days are getting short, grand climbing may be done during the whole of the month. Once the weather breaks, and heavy snows fall, no good climbing can be done. The presence of the Gulf Stream causes a rather larger rainfall in Norway than in the Alps. Often bad weather in the Alps means excellent weather in Norway, and vice versa.

Routes of Access, Travel, etc.

Travelling facilities have much improved during the last few years. The steamboat service from England is better, but more remains yet to be done in this respect. The North Sea has not improved, and never will. A quickened train service from Christiania to Throndhjem shortens the journey up to the romantic north by a good day. The completion of the picturesque Bergen to Christiania railway has revolutionized travel in many ways, both good and bad. The usual routes to Norway are by Hull or Newcastle to Bergen, Christiania or Throndhjem. Dozens of public steam-yachts, some starting from London, run every summer. Some are ocean liners of a large tonnage, and they may occasionally be used. To 'consult Cook' is good advice.

Bergen is the best starting-place. From thence mountaineers may proceed direct by steamer to Skjolden at the head of the Sogne Fjord, and from thence may now drive up to Turtegrö, the favourite centre for the Horungtinder—one of the finest ranges in Norway; or, and better still, they may go by rail to Vossevangen, drive to Gudvangen and then take steamer. Or further, by rail to Myrdal, and drive to Aurland and take steamer there.

Bergen is reached in about thirty-six hours from Hull or Newcastle. Numerous steamers leave there for every mountaineering district. Three days must be allowed by steamer from Bergen to Svolvaer, the centre of the Lofotens. Another day to Tromsö and Lyngen Fjord. It is always advisable to book berths on the north-going boats a fortnight before leaving. Thos. Cook & Son can do this.

Christiania is a good starting-point, and the railway to Throndhjem much shortens the time to get to Arctic Norway. The mineral railway, terminating at Narvik, near the mouth of the Ofoten Fjord, close to lat. 69°, is in direct communication with Stockholm, from which a 'Lapland Express' runs two or three times a week. By means of this, Arctic Norway can readily be reached by those who prefer railway travelling to steamboats—mostly within the Skjaergaard (or Skerries).

The return fare, Newcastle to Bergen, food included, is £6 first class. Rather more by Wilsons. The cost

of two men for a three weeks' tour in Central Norway, including going and returning, should be from £20 to £25 each. I have done it for considerably less. It may also easily be increased to £30 or £35 if the travellers are ultra-luxurious in their ways and habits. It should never be forgotten that a *krone* (1 kr.) is worth 1s. 1½d. Many novices, used to francs and lire, forget this fact. One pound only produces about 18 *krone*, and not 25. A large number of persons who take yachting cruises in huge steamboats, and who only land here and there, throw about their money in a wicked manner, and have much spoiled the very few natives with whom they have come in contact. Away from the haunts of the tourist horde, on the west coast, prices are still very reasonable. Tips must not be given on quite so generous a scale as in the Alps. (These prices are pre-war.)

Expense.

For camp life excellent provisions are obtainable in Christiania, Throndhjem and Bergen, and by getting them in the country the worry of passing the Customs, which is not very serious, is avoided.

Equipment.

Experience shows that bacon and porridge form a great stand-by for a camp breakfast. First-rate sides of Yorkshire bacon and good oatmeal can be bought in the three above-named cities. As tinned meats, useful as they are, have their limitations, it is well to purchase a leg or two of mutton whenever possible There is no doubt at all that one can climb infinitely better when fortified by fresh, rather than by tinned, meats. A trout-rod, and the ability to use it efficiently, is often most serviceable anywhere in Norway, and in the Lofotens a few sea-fishing appliances frequently add a welcome change to camp meals. One result of the great cod fishery in the Far North is that excellent French and Spanish wines are procurable at the posting stations at reasonable prices in Arctic Norway. Speaking generally, the farther north one goes the more comfortable are the steamers, and certainly the more interesting is the company met with. Ashore, the hospitality which many of us have met with leaves behind most happy memories.

With regard to the equipment requisite, generally speaking what is suitable for Switzerland is fit for Norway. It must, however, be taken for granted that,

except in Christiania, and possibly to some extent now in Bergen, no alpine nails, ice-axes, goggles, alpine rope, etc., are procurable. If extra boots are not taken, it is also very desirable to take an ample supply of spare nails or screws. With these much can be added to the security of a party, by fitting up a casual porter or two with nails of a kind which he has probably never seen before. He may at first object, but in the course of the first day on the snows he will heartily approve, unless he may happen to come upon the—not uncommon—highly polished *roches moutonnées* of gneiss.

No longer is it necessary to take tents into Jotunheim or elsewhere in Central Norway, as comfortable inns and mountain huts are to be found here, there and everywhere. In Arctic Norway it is otherwise. In many places not only are tents a luxury but also a necessity, unless mountaineers have the use of a yacht where they can sleep, or unless they charter a small steamboat. Even then it is advisable to have tents, as now and then the question of safe anchorage is a difficult one. Nowadays the well-to-do merchants in Lofoten, and also on the mainland, very often possess motor-boats, which can be hired to take mountaineers to remote fjords together with their tents.

In Scandinavia it is a safe maxim to hold that the farther north one goes the more numerous are the mosquitoes. Hence mosquito nets should always be taken north of Throndhjem. Mosquitoes, fortunately, are not always in evidence even in hot summers.

Guides.

The question of guides is a difficult one. At least 90 per cent of the best climbing in Norway has been done without them, solely because they were non-existent when most needed. There are a few excellent men, experienced alike on difficult glaciers, on steep snow slopes and on rocks of the Chamonix Aiguille type, but their number is very limited. Several are to be met with in various places in the Jotun Fjelde, which include the Horungtinder.

In the neighbourhood of the Justedals-brae, which is by far the largest snow field in Continental Europe, and over 400 square miles in extent, there are naturally a few good icemen able and willing to tackle the very complex glacier problems. They can be found at Fjaerland, in the valley of Justedal, at Stryn, Olden

and Loen, and probably also by now in Stardal and Jölster.

At or near Öie on the Hjörund Fjord, two or three very fair guides may be found for the Söndmöre Alps. These men have been trained more or less by British mountaineers. The same may be said for Romsdal, Eikisdal, as well as for Sundal in Nordmöre, where in the adjacent Troldheim are a few fine glaciers and interesting peaks of gneiss. At the same time, it is true that in every mountain valley in Central Norway there is at least one excellent cragsman to be found, who is invariably called to rescue crag-fast sheep or goats. These men, shod in *snaukopper*, or soft-soled shoes, climb fearlessly on the smooth glaciated crags of gneiss, and make excellent guides so far as rock climbing is concerned.

In Norway, which is at the same time the most democratic and the most conservative country in Europe, the guides and porters are often much better educated than their fellows in Switzerland, and know how to read a map intelligently. They are frequently landowners on a moderate scale, and consider that they confer a favour by acting as guides. They will not use the prefix 'Mr.' or 'Herr'; and why should they? Frequently they can trace their ancestry back to the Viking Age, and even occasionally to the "Early Kings of Norway." Though generally very nice fellows, they are fully conscious of the monetary value of their services, i.e. when they are really capable men. They have not yet learned to carry as much as the Swiss. As the summer is short, there is more than enough work to occupy the whole manhood of any particular district on the land without question of mountains. This condition has become of late years much aggravated by the enormous emigration to Canada and the United States.

Within the Arctic circle, amongst the hundred and twenty miles of aiguilles of gabbro and granite in the Lofoten Islands, there are no real mountain guides. This is the case, too, on the whole mainland of Norway within the magic circle, whether it be amongst the aiguilles of Lyngen Fjord or the weird truncated pyramids of gneiss along the coast, though even here a few good cragsmen are to be found.

We must to some extent make an exception in the case of the nomad Lapps who wander with their reindeer across the glaciers. The gallant French explorer of the snow fields and glaciers along the Swedish border, Monsieur Charles Rabot, made use of some of these men, and in his interesting book, *Au Cap Nord*, has recorded his experiences.

General Topography and Structure.

Though Norway is 1100 miles in length, the mountains which afford scope for indulging in the sport of mountaineering are confined between lat. 60° and 70°, i.e. from the glaciers of the Folgefond to the north point of the peninsula of Lyngen Fjord. More or less they are groups where gabbro has been upheaved through the surrounding silurian strata, granite or gneiss. These groups are unconnected save by relatively uninteresting rolling fjelde, the haunt of the wild reindeer and its enemy the lynx. Though there is as good climbing to be found in Norway as in the Alps, no mountain attains the height of 9000 feet, and consequently there is no continuous ice stream falling so far as that from the summit of Mont Blanc to the snout of the Glacier des Bossons. But there are many continuous icefalls of over 5000 feet, and some glaciers which descend over 6000 feet nearly to the fjords below. In many cases, as these ice streams are exceptionally steep and are hemmed in by straight-cut mountain walls of gneiss, the ice is more compressed, harder and of a deeper blue colour than what one sees in Switzerland. Notably is this the case in the glaciers of the Justedals-brae. There are also similar conditions in Lyngen Fjord in Arctic Norway, e.g. in the case of the noble Fornæsbrae, descending from Gjækkevarre—the Mont Blanc of the North.

The finest range in Central Norway is that of the Horungtinder and portion of the Jotun Fjelde. Its dominating point is Skagastölstind. This range has the advantages, and likewise possibly the disadvantages, of possessing a well-recognized centre at Turtegrö, which, from a picturesque point of view, is at the wrong side of the range. The many fine peaks are nowadays being worked out with a persistency worthy of Wasdale Head or Pen-y-Pass. Those of us who know the Coolin in Skye well, know what grand climbing is suggested by the word 'gabbro,' the formation of the Horungtinder.

In several other districts gabbro spires give the tone to the picture and afford magnificent climbing to the mountaineer. Notably is this the case in Söndmöre, on each side of the Hjörund Fjord, where some lovely mountains, such as Slogen, bathe their feet in the sea. Unfortunately, they frequently have their heads bound up with fleecy clouds, owing to their proximity to the Gulf Stream and to nature's condensers in the form of huge snow fields. The 120 miles' length of the Lofoten Islands are also built up of granite and gabbro. The first view of these islands gives a sensation of exaltation and joy. And their colour! It is the same formation as the Coolin, and the same influences are at work. The Gulf Stream, that rare and subtle painter, simply touches the mountains with its moisture-laden breezes, and, helped by the sun, a richness and delicacy of tint appears which is unknown elsewhere in Europe. It lacks only the contrast which the Coolin possess of the changing colour of heather.

The mountains of the Lyngen Peninsula, a grand region of rugged aiguilles and huge glaciers, which stream down seawards from, in some cases, a height of over 6000 feet, all consist of gabbro. But it must not be concluded that the only good climbing is confined to mountains of this order. As in the Alps, granite and gneiss hold their own, and very many beautiful mountains afford arête and face climbing of exceptional interest.

In Romsdal, Eikisdal and Troldheim, the latter until recently a much neglected district, there is grand sport to be had, not only on rocks but on steep and difficult glaciers as well.

North of Throndhjem are the Oxtinder. Though high and girt about their loins with glaciers, they are, it is said, disappointing. The glacier region of Svartisen and a few rock peaks south of Bodö, but yet within the Arctic circle, deserve more detailed attention from our countrymen than they have yet met with.

On the mainland, north of Bodö and the Salten Fjord but south of the Ofoten Fjord, are some of the most beautiful and some of the most fiendish-looking rock mountains conceivable in a mountaineer's nightmare. In the first category is the Strandaatind, which has a most lovely outline, and is also a difficult mountain to ascend. Not far away are two hideous and truncated

obelisks. These are in South Folden Fjord. At the head of this fjord, and on and within the Swedish frontier, there is a grand glacier region.

Sixty-five miles farther north the Stedtind, or Anvil peak, a monolith with one diagonal crack across the face, rises 5200 feet out of the sea. Probably it is the most hideous mountain monster on our planet. Yet there are only 15 feet of especial difficulty to be crossed when the ascent is made from the back. True, but these 15 feet are highly sensational!

There are still left unclimbed in this region other gruesome peaks which await mountaineers capable of taking the initiative. The glaciers of Frostisen and a few of the high peaks rising out of this snow field have been fairly well explored, but as yet little information has been given us on the subject.

Up to comparatively recent years there was a strange ignorance about the higher mountains in Norway, and great uncertainty as to which was the highest. Once upon a time Sulitelma held the honour. Snehaettan also had a short reign. In an old atlas of mine, Skagastölstind is termed "the culminating point of Scandinavia." Then came the plea for Galdhöpiggen; and not many years ago a claim was put in for Knutshultind, which was never looked upon seriously. For a good many years, however, Galdhöpiggen has been recognized as the king, though its neighbour, Glittertind, was only twenty odd feet lower. The summit of the former consists of a narrow rock ridge terminating abruptly in a precipice at one end, which therefore cannot hold much snow. The latter is a snow dome. I pointed out many years ago the probability that after two or three years of unusually heavy snows the snow dome would rise, that Glittertind would be raised to the throne, and Galdhöpiggen be deposed. This has come to pass, and now Glittertind —a much duller mountain than its rival—is "the culminating point of Scandinavia." It may and ought to be deposed ere long.

Local Conditions.

In both Central and Arctic Norway there are some conditions which do not prevail in the Alps. The long nightless days have both their advantages and their disadvantages. In Arctic Norway there is a topsy-turvyness to which we are unaccustomed. One never knows when to go to bed,

and, as the snow does not get so soft as in Central Norway, there is a great temptation to delay departure and waste much time on the way. There is naturally a feeling of romance in arriving on the summit of a difficult mountain a few minutes before midnight, and of watching the sun roll along several degrees above the mountain horizon. Still, for the sake of the sub-conscious machinery of the body, it is best to observe the usual hours for work and for sleep.

In Central Norway I have seen the sun both set and rise again a couple of hours later while I was traversing a difficult mountain ridge. But there is an enormous difference between the length of days in the end of June or July and that in the middle of August. Occasionally mountaineers who do not recognize this fact get benighted.

In Central Norway the snows become soft by 9 a.m., though not to the same extent as in the Alps. Still, an early start is desirable when a fine expedition is contemplated. Especially is this the case when crossing the Justedals-brae or other huge snow fields.

Avalanches fall as they do in the Alps, but rarely between the end of June and the beginning of September, and stones, icebound at night, are loosened by the sun in the morning, and come toppling down in the orthodox manner, and may, perchance, be a danger to the unwary. In fact, the ordinary dangers associated with high mountains exist equally in Norway.

In some regions magnetic rocks occur, and then the compass is of no use. Where this is the case, and mists come on, and there is no wind to indicate the cardinal points, the interest of the expedition may unexpectedly be increased.

Ice, hard blue ice, is much more often encountered on the Norwegian glaciers and gullies than in the Alps.

On very steep snow slopes and glaciers in the Far North one frequently comes upon a deep square-sided groove in the snow; at the top of the slope it may be 12 feet wide and 4 feet deep. This imperceptibly widens, during a descent of between 1500 and 2000 feet, to a groove, still square-sided but now 20 to 25 feet in width and 7 or 8 feet deep. Such grooves are most difficult to cross, and on one memorable expedition on Rulten, when victory was almost assured, the party was driven

back by the apparent danger of making such a crossing. These grooves show no sign of the work of falling stones or rocks, but are probably, at an earlier period of the year, caused by water. I have never met similar grooves in Central Norway, nor yet in the Alps.

After a long spell of fine weather during the nightless days of the summer months, the glaciers may become very dangerous by reason of a peculiarity in the character of their crevasses. The larger and the flatter the glacier, the greater the danger. This is especially the case on the Justedals-brae, though by no means confined to that region. The condition is caused, in my belief, principally by the comparatively low altitude of the sun above the horizon. The rays of the sun are directed more horizontally upon the snow, and for a considerably larger number of hours during the long days in Norway than is the case in the Alps. This approximation to horizontality causes an abnormal melting power to be directed to the under side of the snow eaves and of the bridges of open crevasses. Especially is this the case when these eaves are attached and frozen to the north or northerly walls of the crevasses. Under these conditions crevasses of 25 or 30 feet in width may only have the appearance of a width of 2 or 3 feet. Not only this, but they often have clear-cut and well-defined edges and not jagged lines. On the surface there may be little or no indication of the hidden dangers which are shielded from view.

The interest in hot seasons may be much increased by the presence of 'pink snow,' *Protococcus nivalis*, which has been known to lie in patches covering several acres.

In Norway there are several great snow fields, Greenlands in miniature. Hill and dale on these snowy uplands are alike covered with glacier, and only here and there rocky islets or *nunataks* appear, and usually as alpine gardens. In nearly all cases the rock below the ice sheet is gneiss, and if the glaciers were to disappear, rolling fjelde, or rounded hog-backed peakless mountains 5000 to nearly 7000 feet in height, would appear. Such snow fields are rare in the Alps; consequently British mountaineers have little experience, on a large scale, of glaciers which rest on broad, gently sloping ridges, and which slowly descend, maintaining connection

at the same time with glaciers on either side moving nearly in the same direction. The process is natural enough. The results are more or less novel and appalling. On the ridges gravitation is at work, and the ice moves onwards in three directions: down the main axis of the ridge and downwards on each side. In years of little snow, consequently, scores of quadrangular masses of *névé* and ice are left, on every side of which are deep square-walled crevasses. Woe betide the party which descends such a ridge without using the greatest care. Few men may have experienced these conditions, but those who have will always retain a lively memory of them.

It is not necessary to repeat, to mountaineers, that most Englishmen who have climbed in Norway return again and again, to a country which has still much of the romance of exploration, and, for them, the sympathetic interest of an historical connection with their racial consciousness. I myself like to believe that we, who take our pleasures on the mountains—and the more grisly these mountains are the better we like them!—have inherited the passion from our 'Norsk ancestry,' who, as we gather from an old Saga, indulged in the sport of cliff climbing nearly one thousand years ago.

CHAPTER XVII

THE SOUTHERN ALPS OF NEW ZEALAND

BY MALCOLM ROSS

WHILE distance lends enchantment, it also, not infrequently, presents difficulties. The mountaineer, probably more than most people, realizes this as, beside his winter fire in England, he sees through the smoke-rings of evening pipes alluring visions of the pine-clad Rockies, of the lonely Caucasus, of the giant Himalaya, of the high Andes and of the far-distant Southern Alps. Most climbers are also workers, and it is the time taken and the expense of the journey that no doubt give them pause when they think of the distant ranges; but more particularly of the Himalaya or the New Zealand Alps. In regard to the latter, however, the expedition need not be an expensive one. The return passage from London to New Zealand by the big direct liners is not costly.

A good service is run by the New Zealand Shipping Company and the Shaw Savill & Albion Company.

Routes, etc.

The voyage out is by the Cape of Good Hope and the return by Cape Horn. The return passages by the alternative and more interesting route between London and Lyttelton cost £132 first class and £75, 10s. second class. The British steamers on this route belong to the P. & O. Company and the Orient Company. The passage occupies about six weeks, but it can be shortened by a week by crossing the English Channel, taking train across France and joining the steamer at Marseilles.

The advantage of this route is that we are often within sight of interesting lands and call at quite a number of ports—Gibraltar, Marseilles, Port Said, Suez, Aden, Ceylon, Perth, Adelaide, Melbourne and Sydney. At the southern end of the journey time can be saved by

taking train from Adelaide to Melbourne, and thence a Union Company's steamer to the Bluff, which is the southernmost port in New Zealand. The New Zealand steamers on this route may not, however, be considered so good as those running from Sydney to Auckland or Wellington, and the passage to the Bluff is generally a colder and more stormy one than that from Sydney in the more northern latitude. Besides, Sydney, with its charming harbour, is well worth seeing, and time can still be saved by taking train right through from Adelaide to Sydney. Still quicker though slightly more expensive routes are those across the Atlantic via San Francisco or Vancouver. A change of scene is provided by either of these routes, which avoid the heat of the Red Sea and the cold of the more southern route taken by the direct steamers. Another alternative would be to go East and return by the Western line, thus circumnavigating the globe; and variations in the latter route can be made by which Java, China and Japan can be visited. Yet a further choice will be opened up with the completion of the Panama Canal. My own preference would be to take a return ticket by P. & O. steamer between Marseilles and Adelaide, travel by train from the latter port to Sydney, and from Sydney proceed direct to Wellington, New Zealand, by one of the Union Company's steamers. At Wellington full particulars regarding the charges *en route* to Mount Cook and the cost of guides and accommodation can be obtained from the Tourist Department or from the writer of this chapter, who will willingly place at the disposal of any climber any information and advice that he can give.

Local Conditions, Guides, etc.

At Mount Cook there is an accommodation house, under Government control, and all charges are reasonable. The best guides are servants of the Government. Their services, however, may not always be available when most wanted, and a man will do better, if he can afford it and desires it, to bring with him his own guide.

The ideal party would be one of three first-rate amateurs, or two amateurs and a good guide, used to both rock and ice work. It would be practically independent of local assistance, and ready to seize all opportunities of fine weather to do first-class climbs or new expeditions. The local guides would willingly co-operate

with or advise such a party regarding local conditions, weather, routes, etc.

The weather in New Zealand, as in all mountainous countries, plays an important part in such expeditions, and the climber of high peaks will be well advised to keep his eye on the dreaded north-wester, which sweeps across the Pacific Ocean and assails the beetling crags and snowy summits of the great range with a force and fury which it is difficult successfully to combat.

Our mountains, though not so high as those of the European Alps, are practically the same height from a mountaineering point of view, because in New Zealand the snowline is so much lower and the ranges rise directly from lower elevations than they do in Switzerland. Our alpine chain seems to be more heavily glaciated and the rocks more friable than is the case in Europe. Our glaciers are certainly larger, and the moraines upon and beside them such as to tax the patience if not the endurance of the climber unused to them. The scenery is grand from the purely alpine point of view, but one used to Swiss mountains will miss the well-formed road, the fine hotels and the high mountain hut, to say nothing of the mountain railway, which we must hope may never become the vogue in New Zealand.

On the west coast the scenery is more varied than on the east, because of the forest that clothes the lower Alps ; but the weather is wetter, and the dense vegetation often a bar or at least a hindrance to the attainment of a high bivouac. The difficulty is accentuated when one has to carry one's own tent and provisions on one's own back, although there is not nowadays the same difficulty in obtaining porters which the pioneers had to put up with. Such huts as there are, are low down in the valleys ; and if new ground is to be broken, the expedition should come provided with its own tents and sleeping-bags, and be prepared often to spend the night under the more or less friendly shelter of some detached rock. To the mountaineer, however, the dispensing with such luxuries will only add to the joy of his new climbs and tend to make him more fully appreciate the luxuries of civilization when, with his peak in his pocket, he returns again to the lower altitudes. From the technical point of view the climbing is very much like what it is in Switzerland ; but the strange climber would always

do well to remember that the dangers from avalanches and falling rocks are not so accurately mapped out as they are in ranges that have been climbed by several generations of experienced mountaineers.

While the new field will certainly prove fascinating from the climber's point of view, it is also worth remembering that it abounds in objects of interest to the geologist, the botanist and the zoologist. The glaciers are among the largest and most interesting in the world; the flora is of the most diversified character; and the fauna, though limited, is curious.

Topography and Structure.

Large as the glacier system is at the present day, it is small as compared with the extent of the glaciers which descended far down the plains in the Pleistocene period. The greatest accumulation of ice and snow lies at the head of the Tasman and Murchison glaciers, on the eastern side of the main range of the Alps. The Mueller, the Hooker and the Godley glaciers, on the same side, are, however, likewise of large extent; while on the western side of the Mount Cook Range there are other glaciers of large size, one of which—the Franz Josef glacier—descends to within about 600 feet of the sea, and has beautiful tree-ferns, and a vegetation which appears almost semi-tropical, growing within a few yards of its terminal face.

One peculiar feature of the Southern Alps is the absence of any number of low sub-alpine passes over the main range. The principal low passes are the Haast Pass, leading from Lake Wanaka to the west coast; the Hurunui Pass, dividing the sources of the river of that name; and Arthur's Pass, over 3000 feet high, across which the coach runs through the wonderful scenery of the Otira Gorge to Hokitika and Greymouth. The first point to be noticed in regard to the central chain is that it does not present an unbroken line of watershed, but rather a series of peaks and broken ridges, separated from each other by deep ravines, and for the most part not easy of access. The clue to this system of ravines and ridges is to be found in the fact that the Palæozoic rocks forming the main range have been at a very early period subjected to extensive pressure, the effect of which has been to crumple them up into huge folds, the upper portions of which have been removed, leaving the remaining portions of the strata standing up on edge, either

in a vertical position or at very steep inclinations. The strike of the beds differs from the general direction of the dividing range by 33°. The rule which has been found to prevail in other mountain chains of similar formation appears also to hold good in the central chain—viz., that the greatest amount of denudation has taken place along the original ridges, which are now occupied by valleys, whilst the existing peaks and ridges are on the sites of former depressions.

The next feature to be noticed is the jointed structure of the rocks. Although the joints cross each other in all directions, apparently without order, there are two prevailing systems of joints which have an important influence on the configuration of the surface. These are: First, a system of vertical cross-joints at right angles to the stratification, and running in unbroken lines for great distances, with such regularity that they might easily be mistaken for planes of stratification were it not for the frequent occurrence of beds of trap-rock, the outcrop of which marks unmistakably the true bedding; secondly, a system of joints, more or less inclined to the horizon, not running in parallel planes, but arranged in a series of curves radiating from a common centre.

The effect of this system of jointing, combined with the strike of the beds, or the direction of the axis of folding, is to produce two distinct systems of valleys in the central chain, the direction of which is very remarkable. The one radiates from a common centre, situated about fifty miles north of Mount Darien, in the sea near Cliffy Head. This system includes all the principal valleys from the Teremakau on the north to the Makarora on the south, their direction varying from N. 82° E. to S. 30° W., giving the idea that the country has been starred, just as a mirror is starred by a violent blow. To the other system belong the valleys of rivers and water-courses, running either on the strike of the beds, or in the direction of the cross-joints, or in a zigzag course, following alternately these two directions and giving to the cliffs which bound these valleys a peculiar rectangular appearance, resembling ruined masonry on a gigantic scale.

The western slope and part of the central chain consist of crystalline rocks and metamorphic schists resting on

a basis of granite, that presents itself here and there to the view in the rugged bluffs and declivities on the west coast. To the eastward of the crystalline zone stratified sedimentary rocks appear, such as slates, sandstones, conglomerates and indurated shales. These compose the greater part of the eastern side of the central chain, exhibiting everywhere huge foldings. The extensive development of limestones such as are peculiar to the European Alps is totally lacking, and it is easily seen that only the eastern half of a complete mountain system has been preserved, while the western half is buried in the depth of the main.

Flora and Fauna.

At Mount Cook the botanist has a splendid field before him. The alpine and sub-alpine flora is of the most beautiful and diversified character, and to the traveller making his first visit from Australia or the Northern Hemisphere it will also have the charm of novelty. Among the shrubs there is considerable variety, and many of the bushes are during the autumn laden with prettily coloured berries. Among the larger trees a variety of beech is most prominent. The pretty green foliage of the broadleaf is also conspicuous, and a number of the Coniferæ. But it is probably among the herbaceous plants that the botanist will delight most to linger.

On Mount Torlesse, in the lower and more eastern range, Dr. von Haast, during his early explorations, collected over two hundred flowering plants, over thirty of which were new to science, and even in these later years new discoveries are still being made.

Splendid herds of red deer inhabit the heights and vales of the lesser Alps, so that after the mountaineer has bagged his peaks he can change his ice-axe for his rifle and bag a few fine heads as well. Recently chamois have been successfully acclimatized in the Mount Cook region, while elk and moose have been liberated in other localities. In the rivers of both the North and the South Island there are fish that will make the rods bend and the reels give to some purpose.

The birds of the alpine and sub-alpine regions are especially interesting. The kiwi and the kakapo, those strange flightless birds of the South and West, will prove a novelty to the explorer from northern climes; while the inquisitive friendly weka, with his rudimentary

wings, and the curious kea, who digs into the loins of the living sheep with his powerful hooked beak to make a meal of the kidney fat, will be a never-failing source of interest to the traveller, who will find the former a thief and the latter rather a noisy companion whilst he is endeavouring to seek repose in one or other of the iron-roofed mountain huts. Wood-pigeons and a bush parrot known as the kaka are also to be found, and, in unexplored country, may make a welcome addition to the larder. A native thrush, two species of cuckoo that come down from the equatorial islands, wrens and fly-catchers are also met with; while the tui and the bell bird sometimes fill the woods with glorious song. In a chapter on mountains there is not space to do them all justice; but anyone who is specially interested in that strange bird, the kea, will find his habits and his character more fully described in my recently published book, *A Climber in New Zealand.*

Glaciers.

The following table, showing comparative sizes of the Canterbury or east coast glaciers compiled by Mr. T. N. Brodrick of the New Zealand Government Survey Department, will give some idea of the extent of the glaciation and prove interesting to anyone contemplating a mountaineering expedition to the Southern Alps:

TABLE SHOWING COMPARATIVE SIZES OF THE CANTERBURY GLACIERS

Name.	Area of Glacier.	Area of Country from which Supply of Ice is drawn.[1]	Length of Glacier.	Average Width.	Greatest Width.	Narrowest Width.
	Acres.	Acres.	Mls. Cs.	Mls. Cs.	Mls. Cs.	Mls. Cs.
Tasman .	13,664	25,000	18 0	1 15	2 14	0 60
Murchison.	5,800	14,000	10 70	0 66$\frac{7}{10}$	1 5	0 42
Godley .	5,312	10,560	8 0	1 3	1 55	0 58
Mueller .	3,200	7,740	8 0	0 50	0 61	0 37
Hooker .	2,416	4,112	7 25	0 41$\frac{3}{10}$	0 54	0 30
Classen .	1,707	3,972	4 70	0 43$\frac{3}{4}$	0 73	0 21

[1] This is not the whole watershed, but only that portion on which the *névé* snow lies.

First-class mountains in the New Zealand Alps may be said to range in height from 10,000 feet to 12,347 feet, which latter is the height of Mount Cook. All the mountains of 10,000 feet and over have now been climbed; but there is much interesting work yet to be done in connection with new routes and high pinnacles and passes on the main range, while there are still many untrodden peaks of the second class scattered over a wide extent of explored and unexplored country. In short, there is in New Zealand work for generations of climbers yet to do.

CHAPTER XVIII

THE PYRENEES

BY CLAUDE ELLIOTT

THE claims of the Pyrenees on the alpine climber have been set forth with charm and vigour by Count Henry Russell and Mr. Packe, and yet they remain singularly neglected. Possibly it is the very ardour of their advocates that has betrayed their cause. For it is not as the rival of the Alps, but as a preparatory training-ground for the Alps or as a refuge from the cosmopolitan tourist, that the Pyrenees should be regarded. Let it be said at once that as a climbing-ground pure and simple there can be no comparison between the ranges. The biggest peak in the Pyrenees has a height of 11,160 feet; their glaciers are small—their total area is about 13 square miles—they do not flow down into the valleys, but as a rule are as broad as they are long; and the snow-line is about 1000 feet higher than it is in Switzerland. The very lack of snow and ice at once renders the ordinary routes up the larger Pyrenean peaks infinitely more easy than the ordinary first-class alpine ascent.

Of course rock climbs of great difficulty can be found if search is made for them, but the normal routes up the rock peaks of reputation, such as the Fourcanade or the Pic du Midi d'Ossau, do not present difficulties approaching those, say, of the Chamonix Aiguilles.

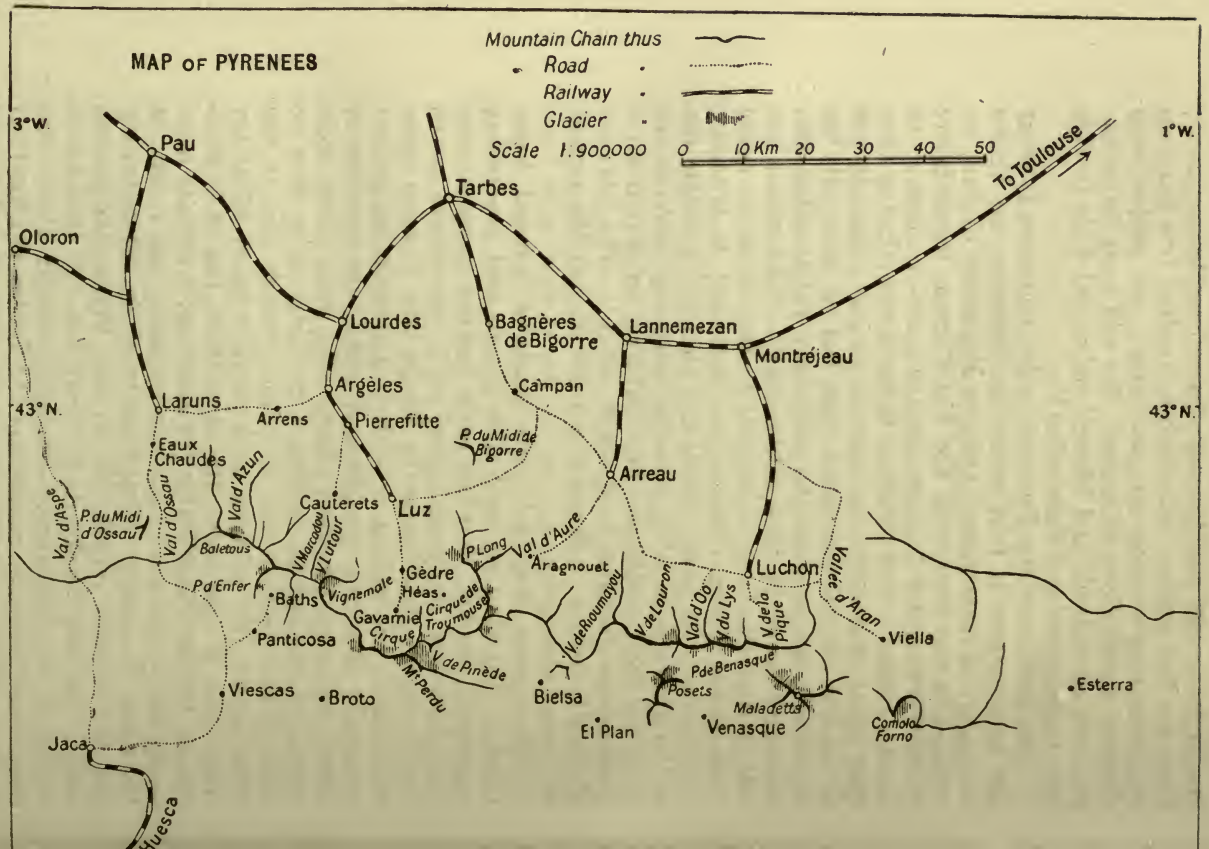
The climbing on the whole resembles that of the western end of the Oberland or of Tyrol. With some exceptions the angles are not steep, the rock is inclined to be rotten, and the snow and ice work is easy. The mountains possess, however, a peculiar charm of their own, which is not nowadays to be found in the Alps, and is due to their solitude, their wildness, their freedom from the works of man. And this very desolation provides the Pyrenees with peculiar difficulties: there the

mountaineer will find himself almost completely alone; there are few guides, few climbing parties, few huts, no good climbing centres, no good maps, and seldom any detailed descriptions of routes. He will have to be dependent on himself and himself only, and it is in this that their appeal and their value lie.

General Topography and Structure.

The portion of the Pyrenees which will most interest the mountaineer is that which lies between the Vallée d'Aspe immediately to the south of Pau, on the west, and the Val d'Aran, immediately beyond Luchon, on the east—a distance of some 70 miles. The structure is more complicated than appears at first sight, because the biggest peaks do not lie on the central frontier range, but on one side or the other, and because the subsidiary ridges often join the main range at very acute angles. The reason for this is that the lines of original folding lie at an acute angle to the general direction of the chain; M. Schrader has pointed out that "while the chain as a whole lies in the direction E. 9° S., this particular direction is not produced by a continuous line, but by a series of oblique folds whose direction is about E. 30° S." The folds are of granite, schist or limestone, and thus provide a great variety of rock work.

The sketch overleaf only indicates *general* topography. Starting at the Vallée d'Aspe and proceeding eastwards, we find that the main frontier range is comparatively low, while the higher peaks are thrown out to the north, the chief being the Pic du Midi d'Ossau (9460 feet) above the village of Gabas, a fine double-peaked mountain of rotten granite and schist, the traverse of which makes an excellent climb. The main range, however, still keeping its schistous character, soon rises to over 10,000 feet in the Balaitous, which lies at the head of the Val d'Azun and provides good climbing. After this it maintains its high level, but it is overtopped by the Pic d'Enfer (10,200 feet), a granite mass immediately to the south and above the Baths of Panticosa in Spain. The frontier chain after passing the Pic d'Enfer culminates in the Vignemale (10,800 feet), a schistous peak with a fine glacier, and then bends south to the ice-covered limestone massif above the Cirque de Gavarnie, comprising the Taillon (10,300 feet) and the Marboré (10,600 feet), on the frontier, and


MAP OF PYRENEES
Mountain Chain thus
Road
Railway
Glacier
Scale 1.900000
0 10 Km 20 30 40 50
3°W.
1°W.
43°N.
43°N.
To Toulouse
Pau
Tarbes
Oloron
Lourdes
Bagnères de Bigorre
Lannemezan
Montréjeau
Argèles
Campan
Laruns
Arrens
Pierrefitte
P. du Midi de Bigorre
Eaux Chaudes
Arreau
Cauterets
Luz
Val d'Aspe
P. du Midi d'Ossau
Val d'Ossau
Val d'Azun
Baletous
V. Marcadau
V. Lutour
P. Long
Val d'Aure
Aragnouet
Luchon
Vallée d'Aran
P. d'Enfer
Baths
Vignemale
Gèdre
Héas
Cirque de Troumouse
Gavarnie
Cirque
Panticosa
V. de Roumagou
V. de Louron
Val d'Oo
P. du Lys
V. de la Pique
Viella
Mt Perdu
V. de Pinède
Viescas
Broto
Bielsa
P. de Benasque
Posets
Maladetta
Esterra
El Plan
Venasque
Comolo Forno
Jaca
Huesca

Mount Perdu (10,900 feet) immediately to the south. A little farther eastwards it throws out a high rib, running into France and culminating in the Pic Long (10,400 feet). Continuing along the main range we find that it maintains its height, and though it never rises much above 10,000 feet it only twice falls below 8000, and then only by a few feet, till it reaches the Val d'Aran. The formation of this easterly portion is of granite, and provides a quantity of good rock climbing. The highest mountains, however, lie in two massifs on the Spanish side of this part of the range. The most westerly of these contains the Pic des Posets (11,040 feet), an interesting peak of granite and schist rising from an easy glacier, and the other is the massif of the Maladetta, culminating in the Pic de Néthou (11,160 feet), the highest summit of the Pyrenees, on whose flank lies the largest glacier of the range. The two massifs are separated from one another by the deep valley of the Esera, where Venasque is situated, which can be reached easily from Luchon, in France, by the mule-track over the Port de Venasque. Beyond the Port the main range is cut across by the Val d'Aran, running roughly west-north-west, which marks a line of geological folding. South of the Val d'Aran and east of the Maladetta group lies the Montarto massif (not to be confused with the Pic de Montarto d'Aran), a rocky ridge, rising out of a snow field on the east resembling a small glacier, of which the highest point is the Comolo Forno (*c.* 10,100 feet) and the most striking the Pic de Bécibéri, some 100 feet lower. Farther eastward and still south and east of the Val d'Aran, is an unusually wild and complex region of granite peaks, averaging 9500 feet, and innumerable small lakes, comprising the Cirques of Colomés, Sabouredo and the Sierra de los Encantados. The main frontier chain starts again beyond the Val d'Aran some miles to the northward, and though it still remains high and still forms one of the most remarkable mountain barriers in Europe, it contains no glacier and little perpetual snow, and on the whole the mountains are less steep. So from a purely technical point of view it is of comparatively small interest to the climber. But there are few people who would not enjoy visiting it, both because of the wildness and desolation of the country, and because hidden away in its recesses is the principality of Andorra, which lies

immediately to the south of the watershed, some 40 miles beyond the Val d'Aran, and accessible without great difficulty from the railway at Ax in France.

It will be seen from this brief description that the range is an extended one, and that the larger peaks are far apart from one another. Moreover, there are few towns among the mountains, and the higher summits are separated from one another by difficult country. On the French side there are a certain number of good roads connecting the northward running valleys, but on the Spanish side there is often not even the faintest of paths. Also from the Val d'Ossau to Ax, 150 miles to the east, no large road actually crosses the main range, and even footpaths across are surprisingly rare. It follows, then, that the Pyrenees are not mountains for the climber who is fond of the comforts of life. A tent or sleeping-bag is absolutely necessary for their real appreciation.

The only centres are Luchon and Gavarnie, but these are not good; the climbing round them is limited, and would soon be exhausted by a competent party, unless it were content with infinite small variations. Gavarnie (5000 feet) is easily reached from Paris via Bordeaux, Dax and Lourdes to Pierrefitte in under 24 hours; thence by a short electric railway to Luz, and finally by 12 miles of excellent road. It contains several good hotels, and in summer it is crowded with tourists. From here a number of interesting peaks can be climbed direct. Immediately to the south is the magnificent Cirque de Gavarnie, above which lies the frontier ridge rising to the points of the Gabiétou (10,000 feet), the Taillon (10,320 feet), the Casque, the Tour de Marboré (10,670 feet) and the Pic d'Astazou. From the Marboré a still higher ridge runs south-east, on which lie the Cylindre (10,900 feet), Mont Perdu (10,990 feet) and the Soum de Ramond (10,760 feet). The frontier peaks may all be climbed in a day from Gavarnie, and the energetic may traverse two or even three of them in the day.

Centres.

The others also are not too far for a day's excursion; but it may be found preferable to sleep in the Cabane de Gaulis, on the flank of the Perdu, or better still, to bivouac.

Hanging on these peaks is a mass of *névé* and broken glacier, allowing difficult variations to be made on the usual routes, which are easy; here alone, indeed, can

glacier work of any difficulty be found. For instance, a route has been made up the Perdu from the north, which involves the ascent of an ice-fall. The rock work is not so satisfactory, but some really hard and interesting ascents have been made straight up these frontier peaks from the Cirque de Gavarnie.

Farther to the east we find first the Cirque d'Estaubé, and then the Cirque de Troumouse, facing north, and cut off from Gavarnie and from each other by subsidiary ridges.

Surrounding the Cirque d'Estaubé are ranged in order the Tuqueroye, the Pic de Pinède and other peaks, providing some difficult rock routes, and accessible in a day from Gavarnie. Above the Cirque de Troumouse is an interesting rock ridge, of which the chief point is the Pic de la Munia (10,300 feet). It is, however, rather far from Gavarnie, and many people will prefer to spend the night at the small but expensive inn at Héas before attacking it.

From near the Munia a ridge runs due north to the Pic Long. This mountain can be climbed by its glacier or by its sound granite rocks in a long day from Gavarnie, or the night can first be spent at Gédre, where also the inn is dear.

To the west of Gavarnie lies the Vignemale, which is ascended by a crevassed, but easy, glacier. Here again difficult climbing can be found if search is made; for instance, it has been ascended by a very difficult couloir on the north side.

Luchon (2000 feet) is even more easily reached than Gavarnie. Trains run direct from Paris via Toulouse and Montrejeau, and the whole journey from London should take just over 24 hours. It is altogether a larger town than Gavarnie, and is one of the fashionable watering-places of the Pyrenees. It has some good if expensive shops.

From here it is easy to attack the interesting granite peaks on the main range. Running southward, a little to the west of Luchon, is the Val d'Oo or d'Astau, enclosed by the Pic du Port d'Oo (10,300 feet), the Perdighero (10,500 feet), the Crabioules (10,200 feet) and the Quairat (10,000 feet). The ordinary routes up these can be accomplished in a longish day from Luchon, and are quite easy according to alpine standards. They may

also be visited on the way to the Posets, which lie immediately to the south.

Immediately to the east of the Val d'Oo and nearer Luchon is the Vallée de Lys, which is dominated by the Pic de Quairat, the Crabioules, the Maupas (10,200 feet) and the Boum (10,000 feet), and the small glaciers on their flanks.

The ascents of these are again rather long from Luchon, but there is an inn some 3½ hours up the valley where the night may be spent.

Farther to the east, and running south-east from Luchon, is the Vallée de la Pique, which leads up to the Port de Venasque. The mountains round this valley are not so fine, and are mostly too easy to demand attention. One exception is the Pic de la Pique (*c.* 8000 feet), a small, sharp rock peak in the valley, with a great local reputation, but not really of serious difficulty.

These are the only peaks of interest in the immediate neighbourhood of Luchon. But by crossing the Port de Venasque (7900 feet), or preferably some more interesting col to the west, and sleeping out, the Maladetta group can easily be climbed. This massif faces the Port de Venasque, and consists of a somewhat amorphous base from which rise several granite ridges and summits—the Pic d'Albe (10,700 feet) on the west, then the Maladetta (10,800 feet) and the Néthou (11,160 feet), from which flow two large glaciers, then the Pic de Salenques, the Pic Moulières, and finally also the Fourcanade (9400 feet). At the foot of the Glacier du Néthou is a hut called the Rencluse. Most people would have preferred a bivouac to the old refuge there, but a new building has just been opened, and the track thereto from the Port de Venasque was in 1919 being marked with blazes of green paint (a unique phenomenon in the Pyrenees, at all events on the Spanish side).

The climbing on the Maladetta group is very easy on the whole. The glaciers are simple, and the rock, though rotten, is easy. The Fourcanade, a bold granite peak, more easily approached from Las Bordas or Viella in the Val d'Aran than from Luchon, presents no difficulty by the ordinary route from the south, but might afford some very interesting fancy routes on the precipitous northern side. The best climbing from

Luchon lies on the main range, and the peaks here have not been so thoroughly explored as those round Gavarnie ; indeed there is room for some most interesting new rock routes to be made. The rock again is granite, and is much sounder than the limestone of the Gavarnie peaks; and the main range provides some beautifully sound rock arêtes.

The mountains round Gavarnie and Luchon are not big, are grouped closely together, and the ascent of more than one can often be made in a moderately long day. Therefore a party which clings to civilization will soon exhaust the more important routes and be driven back on making minor variations. Yet there are no other centres worthy of the name. Of course there are places such as Cauterets, or the Baths of Panticosa in Spain, from which a few peaks can be ascended, but these can hardly be called centres. It follows, then, that a party which wishes for any quantity or variety of mountaineering proper must sleep either in inns or huts or must camp out, and inns are so rare and huts are so dirty that it will be forced to camp out if it is to see the most attractive parts of the range. For it is precisely the wildness and solitude of these parts, far from human habitation,—of the Posets, for instance, or the Balaitous, or the region east of the Maladetta group,—that mark off the Pyrenees from the Alps and give them a charm that is all their own. The wise climber will abandon centres and inns and move along the main range, sleeping out, climbing such peaks as attract him, and occasionally visiting some high village for the sake of renewing his food supplies.

This is the only way in which to see and appreciate the Pyrenees, and if the climber adopts it he will have to face problems very different from those of the Alps. Though the ascents will be far easier than those of first-class alpine peaks, yet the external help will be infinitely smaller. He will find the country a primitive one, and if he is to achieve success he must depend mainly on himself and little on professional or artificial aid.

Guides.

In the first place, little help can be obtained locally. At Gavarnie and Luchon there are a few capable men ; but the majority of the class called guides in the Pyrenees are guides rather in the old sense of the word than in the newer sense of

professional climbers. They are, of course, competent to show the way over the mountains from one place to another, and often even the easy routes up the peaks; sometimes they are good rock climbers. But of actual mountaineering, as a rule they know nothing. Most of them have little knowledge of snow craft or of the use of the rope—which they are apt to regard as a danger to themselves rather than as a safeguard to their party; and above all, they have nothing of the high tradition of the alpine guide. A guided party in the Pyrenees would save time below the snowline in getting across country; but, provided they had a little experience of the Alps and of English climbing, above the snowline they would usually be safer alone.

There is also in the more remote districts a class of men who offer themselves as guides, but in whom it would be unwise to put any trust for any purpose whatever, especially in the off season when the mountains are more than usually desolate.

Though brigandage is now extinct in the Pyrenees, there are still persons who will seize any chance of returning to a modified form of it. But even if we allow that some guides are better than others, the Pyrenees remain essentially mountains for the guideless, and if the climber takes a guide, he will lose half their charm while adding little to his own safety or achievements.

Maps.

Again, in Switzerland, the climber rightly puts implicit confidence in the accuracy of his maps even for minute detail. In the Pyrenees he is unable to do so. There are three maps of importance, and none of them approaches the excellence of the Siegfried map. The first is that issued by the French Ministère de l'Interieur, and published by Hachette et Cie, in plain paper sheet. Its scale is small ($\frac{1}{100000}$), it has no contour lines, it is rather indistinctly printed, it makes little attempt to delineate accurately the higher mountains, and on the Spanish side it gives no more than a general indication of the geography of the country.

The map of the État-Major de la Guerre, which is on a larger scale ($\frac{1}{80000}$), formerly sold at 1 fr. 20 c. a sheet, is even worse; this also is not a contour map, and it stops entirely at the frontier, and leaves the

Spanish side a complete blank. Its printing, moreover, is blurred and indistinct.

The third map is the most useful; it is drawn by M. Schrader, and issued by the Club Alpin Français, in 6 sheets, and covers only the High Pyrenees. It is absolutely essential for the Spanish side, and it is best for the French side also. Its scale is only $\frac{1}{100000}$, and it is not quite so detailed as we might wish. But it gives the contours, and it is clearly printed. Unfortunately most, if not all, of the sheets are out of print and difficult to obtain.

Finally, there is said to be a Spanish military map of the High Pyrenees; whether it exists or not, it is unobtainable by the public.

The defects of these maps are felt even more in the valleys than in the high mountains. In climbing a peak in good weather comparatively little help is needed from a map; but the configuration of the higher valleys and gorges is such that for them a really good detailed map would be invaluable. They are often narrow, steep and heavily wooded; paths are few and very hard to find, or to keep to when found, and the existing maps give little accurate indication of them. In consequence, it is here that a guideless party has special difficulties, and these are increased by the prevalence of the cirque formation. The upper valleys are often cut into two parts by a horseshoe wall of rock, extending right across them from one side to the other, and thus consist of an upper and lower plane with a precipice between. In ascending a valley it is usually not difficult to see an easy way up these cirques, but in descending, when nothing can be seen between the immediate foreground and the valley below, it is often hard to tell where the line of least resistance lies. The map as a rule gives no clue, and a guideless party may have to make several attempts to find a feasible route. Thus it is really in the valleys, and especially in the Spanish valleys, where all difficulties seem to be accentuated, that the lack of a good map is most felt.

There is, however, a prospect that soon we shall be better equipped in this respect, as the publication of the Pyrenean sheets of the new French $\frac{1}{50000}$ map is expected in the course of the next few years, and there is also talk of the issue of a $\frac{1}{20000}$ map of the Gavarnie

peaks. The reproduction of the $\frac{1}{40000}$ manuscript map, which forms the basis of the $\frac{1}{80000}$ État-Major map (France only), has also been discussed.

Huts and Inns.

Another respect in which the Pyrenees will be found more primitive than the Alps is in the absence of climbing huts. There are, indeed, huts in the Pyrenees in certain numbers, but they are shepherds' huts, built of uncemented stones with no flooring, and as a rule so filthy that no civilized person would use them unless driven to it by great stress of weather. The majority of the huts marked on the maps are of this nature, and as they are liable to fall to pieces from time to time, here also the maps may become untrustworthy. (A special instance of this is the Cabane de Turmes, under the Pic des Posets; this is marked in the Schrader map, but has for some time ceased to exist.) There are, however, a very few climbing huts proper, especially near Luchon and Gavarnie, either kept by private individuals for profit, or erected by the C.A.F. on alpine lines.

Inns also are rarely to be found high up in the mountains; on the French side they are more common than on the Spanish, and they are also more likely to be good; in Spain they are sometimes fairly clean, but always very primitive, with a peculiar style of cooking, involving a lavish use of oil, which is extremely unpalatable to most Englishmen.

Probably the best inn in the high valleys on the Spanish side, except at the Baths of Panticosa, which are on a high road, is at the thermal establishment and shrine of Caldas de Bolis. It may be useful to mention this for those who wish to explore the region east of the Maladetta, as it finds no place in Joanne's guide.

Equipment.

In these circumstances, huts and inns being both few and bad, a tent or a sleeping-bag is an absolute necessity in the Pyrenees. The latter is preferable for a party which wishes to be as free as possible; a tent is, of course, more comfortable, but it almost necessarily involves the taking of a mule, and the party will be at once restricted in its movements; the mule will be unable to traverse peaks, and more especially it will be unable to cross a large number of low cols which involve no serious climbing, but which

would be too difficult for four legs. This means that the party would be able to cross the main range only at a few points, and in moving along the range it would often be forced down into the lower valleys. Again, in bad weather sleeping-bags are not such a disadvantage in the Pyrenees as elsewhere, for their limestone and schist tend to weather into caves, and if a bivouac is made near a cave or an overhang or a shepherds' hut (and there will generally be little difficulty about finding one of these), shelter can at once be found in the event of storm.

On the other hand, a party travelling without porters or mules and sleeping out will find that it has a great weight to carry. The sleeping-bags ought to be thick, as it will often be necessary to bivouac at about 7000 feet, which is occasionally above the tree-level, and warmth at night is worth a few extra pounds. Below the tree-level it is easy to make a fire, but a large supply of wood must be collected, and some wakefulness is required to prevent the fire from going out in the small hours of the morning when the cold is greatest. For cooking it is usually best to use an aluminium cooker with methylated spirits. A large quantity of food must also be carried, especially on the Spanish side, where a human habitation may not be met with for four days on end. Occasionally a shepherd may be able to provide some cheese, or a limb of an izzard, the Pyrenean chamois; but a climbing party will have to rely mainly on the high villages for supplies, and these are few and far between. The French villages are more civilized, and will provide more luxurious food; but the Spanish villages are more worth visiting, the people are kindly, and at least the necessaries of life are obtainable. Usually they can provide coffee, chickens, sardines, eggs and, of course, bread. But jam, potted meats, compressed soups, etc., are better brought straight from England, though they can be bought as a rule at the larger towns on the French side. Chocolate is better bought on the French side, though generally obtainable on the Spanish. It is curious that cows are rarely kept in the high villages, and milk and butter are often unobtainable. On the Spanish side most people will prefer to drink water, as the wine has a peculiar taste; in France it is good, but rough. Streams, of course, are

plentiful in the mountains. The natives carry their liquor in bags of goatskin, smooth on the outside and hairy inside ; the hair imparts a very goaty taste to the contents, so it is wise to add an ordinary English metal water-bottle to one's equipment. If one of the party is a fisherman, it would probably pay to take a rod and line, as many of the small lakes abound with trout. Some people carry with them rope-soled shoes, alpargatas, which are used by the natives for walking on the rough mule-paths and over grass. They are certainly light and restful for one's feet, but it is doubtful whether they are worth their weight and bulk in one's rucksack ; for rock climbing they would be here of doubtful use.

The usual alpine clothing should be worn.

The valleys are very hot in summer, but the temperature and weather in the mountains are similar to those of Switzerland.

It is important to remember that often civilization is several days distant, and in consequence many extras must be taken. Most of these must be brought from England, as it is impossible to obtain real climbing equipment on the spot. It is quite essential to carry a first-aid case, including a few simple medicines, extra pairs of snow-glasses, an extra folding lantern, plenty of candles and matches, string, waterproof bags—sponge-bags do very well—to protect matches, maps, etc. A prismatic compass with a protractor and an aneroid will be found very useful for ascertaining the exact position of the party.

A passport should on no account be forgotten: the Customs officers and frontier police give little serious trouble, but occasionally they are apt to assert themselves, and in this case a passport has a most soothing influence upon them.

If no member of the party knows Spanish, a conversation book would be of use. A small knowledge of French is essential, and in each Spanish village there is usually some one who knows French and will act as interpreter. Still, it would save some trouble to be able to talk a little Spanish ; since the war especially knowledge of French seems to have become rarer at some of the more remote Spanish inns. English, of course, is unknown except in the larger French towns.

Basque would only be of use in the country west of the Vallée d'Aspe, where the range is lower.

It is clear, then, that each member of a party ought to have a rucksack of the largest size. His sleeping-bag, if he takes one, will fill most of it, and the rest will be taken up by his extra clothes or his share of food and equipment. In all, he will be carrying more than is usual in the Alps (probably between 20 and 25 lb.), but not too much to affect his enjoyment.

It is possibly a wise precaution for a party, starting out of condition, to hire a mule to convey their rucksacks—which will be at their heaviest at the start—as far as the first bivouac.

Expense.

One great advantage of a holiday spent in the Pyrenees is its cheapness. This is partially due to the fact that the climber will spend much of his time either in camp or else in small mountain inns, where the charges are quite moderate as a rule, the chief exceptions being the inns round the tourist centres, which tend to be extortionate. On the Spanish side the stranger ought to make a bargain with his host, who expects it of him as a matter of course. This is particularly necessary if the hire of a mule is in question.

In addition, the journey from England is not expensive ; the pre-war return fare to any of the mountain termini ranged from £9 to £10 or £11 first class, and from £7 to £8 second class. Existing rates are perhaps 30 per cent or 40 per cent higher. Guides, if they are used, are also cheap ; 10 to 15 francs a day with food was a normal wage before the war, though they would often demand more. Most mountains near any civilization have a fixed tariff ; the bigger peaks as a rule run from 20 to 30 francs, with a few running to 40 francs (pre-war prices). Thus a party accustomed to the Alps will be surprised at the cheapness of a holiday spent in the Pyrenees, unless, indeed, it spends much time in the centres on the French side.

It is necessary to provide oneself with Spanish money for Spain. French money is not accepted as a rule. If considerable loss over exchange is to be avoided, it is desirable to obtain both French and Spanish notes before leaving England. English money can be changed, at a price, in the bigger French towns.

Some knowledge of the literature of our mountains

is almost essential to the success of a climbing tour, and there is no lack of books and articles on the subject.

Literature.

Baedeker's South-Western France is, of course, good for the more civilized region, but makes no pretence at being a mountaineer's guide. Joanne's *Pyrénées* (Hachette et Cie, 1912, revised to 1914) is better, as it gives fairly detailed accounts of the principal climbs, and contains a good general introduction. Count Henry Russell's *Grandes Ascensions des Pyrénées* (Hachette, 1866) and *Souvenirs d'un Montagnard* (Pau, 1888) are both of value; they describe all the more important routes, but the style is emotional rather than practical. Probably the climber will find Packe's *Guide to the Pyrenees* (Longmans, 1867) of the greatest use; it is essentially a mountaineer's guide, and restricts itself to the region between the Vallée d'Aspe and the Val d'Aran; its directions for climbing the peaks are of a practical nature, and often give as much detail as is necessary. Unfortunately it is out of print, and difficult to find. In addition to these guides we have an account of two climbing holidays, called *Through the High Pyrenees* (Innes, 1898), by H. Spender and H. Llewellyn Smith. This book gives a good picture of the country and of the type of climbing, and it contains an excellent appendix on the "Pyrenees as a Climbing Centre," and an extremely useful bibliography, including a full list of the many papers on Pyrenean climbing to be found in past numbers of the *Alpine Journal* and the *Annuaire* of the C.A.F. It is in these journals, and especially in the latter, that the more difficult modern routes, accomplished since the publication of Packe's guide, are recorded, and here we have a ready means of knowing in which volume to find them. Finally, Belloc's *Pyrenees* makes interesting reading, but it is of more value to the walker than to the climber, and it contains some imaginative detail.

From this short account it will be seen that the Pyrenees make no appeal to climbers who are only content with long and arduous peaks and difficult ice-work, or to those who prefer to climb from a comfortable hotel or a clean hut and who dislike attending in person to the troublesome details of bivouacking and cooking. But to the climber of moderate ambitions, who is weary

of the clatter of Swiss hotels or the picnic-parties on Swiss peaks, there are no near mountains which offer so attractive a refuge. The novice, also, who has spent a few summers behind guides in the Alps will discover that one season of guideless climbing in the Pyrenees will infinitely increase his knowledge of mountaineering in the larger sense of the word ; he will have experience of route-finding both in the valleys and on rock and glacier, of step-cutting, of using aneroid and compass and of camping, and he will return to the greater peaks with a heightened capacity for appreciating the mountains and their craft.

CHAPTER XIX

THE ROCKY MOUNTAINS

BY A. L. MUMM

THE Rocky Mountains form the backbone of the North-American Continent, and the Canadian Rockies extend from the United States frontier in a north-westerly direction for some hundreds of miles. Of the regions which are of interest to mountaineers, the northern limit is marked by Mount Sir Alexander, a peak which rises a few miles to the west of the continental divide or watershed, a little over 400 miles, as the crow flies (*very* roughly speaking), from the frontier, and from 60 to 80 miles beyond Mount Robson. The country situated between these two mountains is full of interest for explorers and climbers, but is at present very imperfectly known and mapped. From Mount Robson southward we possess mountaineering knowledge which is extensive, but not quite continuous and far from complete, as far as Mount Assiniboine, a distance in a direct line of about 200 miles (another rough estimate). Till quite recently nothing of alpine or mountaineering interest was known to exist in the main chain of the Canadian Rockies south of Mount Assiniboine, but, in the course of an official survey of the watershed between Kicking Horse Pass and the frontier (1913–16), no less than four groups of mountains, clad in snow fields and glaciers, and containing three peaks of over 11,000 feet, were discovered. No climbing has as yet been attempted on any of them. They extend for about 40 miles beyond the Assiniboine group.[1]

General Topography.

[1] See *Report of the Commission appointed to determine the Boundary between the Provinces of Alberta and British Columbia*, part i. (1917). It is illustrated by numerous photographs and accompanied by many large-scale maps. A summary of it is given in the *Alpine Journal*, xxxii.

The continental watershed pursues a very tortuous and irregular course, and is probably at least half as long again as the ' air-line ' length of the range. East of the watershed the mountain region extends for a comparatively short distance and ends with remarkable abruptness. Through much of its length there is a succession of minor groups and ranges situated close to the main chain, but separated from it by the upper valleys of the great rivers, which show a striking tendency to run parallel to it. These possess some extensive snow fields and considerable glaciers, and will probably receive attention from climbers in the near future, but very little is known of them at present. Beyond them is a belt of mountains, not attaining to the snow-level but often rocky and bold in outline, which reaches to the edge of the great central plain, and presents to the traveller approaching it by the railway the appearance of a solid impenetrable wall. There are no snow fields or glaciers in this outer belt so far as I am aware. (It may be as well to say here once for all that this qualification is often unavoidable in dealing with an area so extensive and little known as the mountain region of Canada ; it is impossible to give any information at all without putting forward as probable statements which may turn out to be erroneous.) To the west of the watershed, on the other hand, the country is continuously mountainous all the way to the Pacific Coast, three hundred miles away, and there are several ranges, alpine in size and character, standing quite apart from and independent of the main chain. Of these the Selkirks, an immense mountain system, enclosed by the great loops of the Columbia and Kootenay Rivers, are by far the largest and most important.

The outstanding feature of all this region is that till quite modern times it was entirely uninhabited, and for the most part still remains so. Indians in old days came up into the mountains to hunt, and to some extent for purposes of trade, but they did not live among them. Two or three outposts of the Hudson Bay Company, long since abandoned, were the only permanent human habitations. This differentiates mountain travel in Canada in many ways—as soon as the immediate neighbourhood of the railway is left—from mountain travel in the Caucasus or the Himalaya, particularly

with respect to food supplies, roads and methods of transport. In the high mountain region the railways have had little or no effect on the character of the country, except within a few miles of the line.

The Rockies are now accessible by two lines of railway. Of these the Grand Trunk Pacific was completed early in 1914. It enters the mountains by the valley of the Athabasca River, and at the point where it leaves the Athabasca to ascend to the Yellowhead Pass (17 miles away) stands Jasper, destined to become a tourist centre, to which we shall return later. The other line, the Canadian Pacific, which has been in existence more than thirty years, crosses the main chain at the Kicking Horse Pass, and then, after descending into the deep trench of the Columbia River, passes through the very heart of the Selkirk Range. Climbing has now been carried on continuously and systematically for nearly thirty years among the mountains adjacent to this railway both in the main chain and in the Selkirks. It will be convenient to deal at once with the region here indicated, which will be referred to as the C.P.R. district. It is the only region where at the present moment conditions prevail at all resembling those of the European Alps, and climbing within its limits is quite a different affair from climbing elsewhere in Canada.

A climber wishing to see something of the mountains of Canada, who has not ample time at his disposal after arriving among them—I should be inclined to say *at the very least* a month—would be well advised to confine himself to the C.P.R. district, making, perhaps, one short trip of the kind mentioned below. He would find enough, and more than enough, to occupy him.

The 'C.P.R.' District.

Taking the main chain first, the extent of the C.P.R. district may be taken to be the area dealt with in *Baedeker's Canada* (1907), which contains about ten pages packed with accurate and highly condensed information. The alpine particulars given are mainly based on chapters i. to ix. of *In the Heart of the Canadian Rockies*, by the Rev. Sir James Outram, who has been over almost the whole district and has supplemented his own experiences by copious extracts from the original narratives of Dr.

Collie, Mr. Wilcox, and the members of the Appalachian Mountain Club.[1]

The railway enters the mountains from the east by the valley of the Bow River, the principal constituent of the *South* Saskatchewan, and soon afterwards arrives at Banff. The excellent C.P.R. Banff Springs Hotel is the most frequented place in the Rockies; but Banff itself is not a mountaineering centre, though Dr. Collie discovered a good rock climb in the neighbourhood on Mount Edith, and doubtless others might be found.[2] It is, however, of interest to climbers as the site of the Club House of the Alpine Club of Canada (of which more anon), and as the starting-point for Mount Assiniboine. This peak is the highest to the south of the railway, and its ascent is a very fine expedition. Given favourable conditions it can be reached and climbed, and the return journey to Banff completed, within six days. This involves travelling with a camp outfit and pack-horses; but it would be well worth while for a climber visiting Canada for the first time to make one such trip (and this one is probably the most repaying), for, besides being pleasant and interesting in itself, it would give him much useful experience in case he contemplated returning another year, and making a more extended journey off the beaten track.

Soon after leaving Banff, the valley of the Bow River runs parallel with the main chain, passing Storm Mountain and Mount Ball, which can be reached via the Vermilion Pass in two days from Banff.[3]

Thirty-five miles beyond Banff is Laggan, where the railway leaves the Bow River, and ascends by Bath Creek to the Kicking Horse Pass. Laggan[4] is the station for Lake Louise, where there is another first-class C.P.R. hotel (3 miles from the railway), the principal centre for the mountains on the south side of the line. Several of these can be climbed from the hotel itself; and there may be a permanent summer camp for the use of climbers

[1] *Climbs and Exploration in the Canadian Rockies*, by H. E. M. Stutfield and J. Norman Collie; *Camping in the Canadian Rockies*, by W. D. Wilcox; *Appalachia*, vols. viii. to xi.

[2] E.g. Mount Louis, see *Canadian Alpine Journal*, viii. 79, ix. 32; and *Alpine Journal*, xxxii. 68; Mount Norquay, *ibid.* viii. 134.

[3] *Canadian Alpine Journal*, i. No. 1, p. 85, v. 122.

[4] The name of the *station* has been altered to Lake Louise, but it is known as Laggan in all the books.

in the valley of the Ten Peaks. If not, it is easy to have a tent, provisions, etc., sent there from the hotel.[1] A similar arrangement could be made either at Lake Louise or Field for a camp at Lake O'Hara, and this would bring within easy reach all the other peaks which deserve attention, except those of the Ottertail Range.

The last-mentioned group is best attacked from Field, 16 miles beyond Laggan and 8 miles to the west of the Kicking Horse Pass, where there is another C.P.R. hotel, the Mount Stephen House, the best centre for visiting the mountains on the north side of the railway. Besides the hotel at Field there are a chalet hotel on Emerald Lake and two permanent summer camps, one at the Takakkaw Falls ; the other, Camp Warren, I have not been able to locate. It is, of course, also possible to approach the mountains of the Waputik Range by making a short trip up the Bow River, but the Yoho and Emerald Valleys seem to be more attractive. From the climber's point of view these mountains are distinctly inferior in interest to those on the south side of the line, and the same may be said of Mount Hector, the highest summit between the Bow and Pipestone Valleys. East of the Pipestone the mountains of the Ptarmigan Lake district, just opposite Laggan, should be worth a visit.[2]

The best general map that I can discover of this part of the C.P.R. district is the southern sheet of a map of "The Rocky Mountains between lat. 51° and lat. 53°," published by the Department of the Interior. Unfortunately, it comes to an end four or five miles short of Mount Assiniboine. The part of it which is material for present purposes is given in a pamphlet issued by the C.P.R. Company, entitled *The Challenge of the Mountains*. The scale is 4 miles to an inch. The large-scale maps accompanying the Report mentioned on p. 572 show the mountains actually forming the watershed (and this includes the Assiniboine group) southward from Vulture Col and Mount Gordon in the Waputik Range.

Coming now to the Selkirks, Glacier House (about 90 miles by rail beyond Field and 3 miles beyond Rogers

[1] Cf. "A Glimpse of the Rockies," *Alpine Journal*, xxiv. 229 ; *Canadian Alpine Journal*, x. 6.

[2] *Canadian Alpine Journal*, iv. 110, 142, vii. 58, 124.

Pass, where the line crosses the crest of the range), is probably the best of the centres of the C.P.R. district, in so far that the largest number of expeditions can be carried out from the hotel itself, or with only one night out. In this respect Glacier House has very few rivals even in Switzerland. *Baedeker* gives a short summary of these expeditions and an excellent little map of the mountains, which literally surround the hotel.

The Selkirks.

But much more than *Baedeker* is available. Besides Mr. Palmer's exhaustive book (of which more presently), no visitor to the Selkirks should omit to secure a copy of Mr. A. O. Wheeler's *Selkirk Range* and the accompanying map in four large sheets, which covers a large portion of the range on a scale of practically 1 mile to an inch. The topographical information secured by Mr. Wheeler during his survey is embodied in the form of a Climbers' Guide in chapter ii. of *The Selkirk Mountains, a Guide for Mountain Pilgrims and Climbers*, where very full particulars are given as to the number of days and nights required for each expedition, whether pack-horses are available, etc. Huts or cabins are mentioned at Rogers Pass and the Caves of Cheops. There seem to be no huts or summer camps south of the railway, and it must be borne in mind that pack-horses cannot be taken southward into the mountains direct from Glacier House.[1]

The limits in the Selkirks of the C.P.R. district can be easily grasped by examining together the map in *Baedeker* and that in the Climbers' Guide (difficult to read, but useful as showing at a glance the area comprised in Mr. Wheeler's large maps). It will be seen at once that the latter covers a wider area, and in particular has a large extension to the west and south-west, reaching even beyond the Columbia River to the Gold Range—a quite independent group. This extension seems to come well within the C.P.R. district: one or two of the expeditions in it can be taken from Glacier House; the remainder are treated in chapter vi. of the Guide in connection with Revelstoke, which accordingly must be added to the list of C.P.R. centres. Since the publication of the Guide fine climbing has been accomplished on Mount Moloch and other peaks reached by the north

[1] See, on this point, *Alpine Journal*, xxix. 95.

branch of the Illecillewaet River.[1] The extension of Mr. Wheeler's map to the north is unimportant; the notices in the Guide of Mountain Creek and Mount Pearce are not encouraging, and, so far as Glacier House is concerned, the crest of the Hermit Range forms the limit of ordinary mountaineering in this direction. To the south, on the other hand, both maps extend to regions which can only be reached by a journey of some days, and several of the expeditions described in the Guide clearly lie outside the category now under consideration. No hard-and-fast line can be drawn, and the traveller must use his own judgment; only, if he is at all tied as to time, let him bear in mind that estimates of a journey's length by little-trodden trails are necessarily very rough, and that what is called a week's trip may easily turn out to require two or three days less *or more.*

Guides and Equipment.

Swiss guides, to the number of six or eight, are imported every summer by the C.P.R. Company, and endeavours are being made to induce some of them to settle permanently at Edelweiss, near Golden, on the Columbia. They are distributed during the season among the four or five centres which have been mentioned. Anyone desiring their services, the charge for which is (or used to be) $5 per day, should communicate as early as possible with the hotel from which he intends to climb. A mountaineer arriving in the C.P.R. district with his ordinary Swiss outfit could thus enjoy plenty of climbing without any special preparations. Even ropes and ice-axes are supplied at Glacier House, and, probably, at the other centres also. The Hudson Bay Company's excellent blankets can be procured at Banff, and for a single odd night out bedding could probably be borrowed.

There is also plenty of scope for guideless climbing. Some of the expeditions are undoubtedly difficult, and only suitable for an exceptionally strong unguided party; but three reasonably experienced amateurs could accomplish a great deal. As compared with the main chain, the Selkirks offer more snow and ice work and less rock work, and there seem to be more climbs of only moderate difficulty than in the Rockies on the south side of the railway. (For a general comparison

[1] *Canadian Alpine Journal*, v. 34, vii. 33, 48, ix. 17; Palmer, *Mountaineering and Exploration in the Selkirks*, ch. xx.

of the Selkirks with the Rockies, see Palmer, op. cit. pp. 3–10.)

The Northern Selkirks.

Turning now to remoter and less known ground in the Selkirks, to the north of the railway, beyond the Hermit and Clach na Cooden Ranges, a very considerable mountain area is enclosed in the Great Bend of the Columbia River. Pack-horses cannot be used in it effectively, and the conditions of travel are exceptional and extremely difficult; but a large part of it, probably the most interesting part, was explored with extraordinary perseverance by Mr. Howard Palmer's party from 1908 to 1912. Only in the latter year, on their fifth visit, did they succeed in attaining the summit of Mount Sir Sandford, the monarch of the region. For further information the reader is referred to part iii. of Mr. Palmer's *Mountaineering and Exploration in the Selkirks*. Part ii. of this fascinating book is equally valuable as a guide to the mountains immediately south of Glacier House, which have already been noticed. Beyond these a still more extensive region remains to be dealt with.

It will have been noticed that Mr. Wheeler's map, breaking off abruptly along most of its southern margin in the very middle of untrodden snow fields, is itself a challenge to further exploration. His work has been carried a short distance further by the ascents of Mount Beaver and Mount Duncan, and some climbs in the Battle Range, but the regions beyond are still, so far as I am aware, a *terra incognita*, and I am quite unable to say how much further the southern portion of the Selkirks proper continues its alpine character.

The Purcell Range.

Between this southern portion and the main chain of the Rockies is another large mountainous tract forming part of the Selkirks system and known as the Purcell Range, comprising the Dogtooth, Spillimacheen and South Purcell Ranges. A rough idea of its extent and situation may be obtained from the sketch map accompanying Dr. Longstaff's paper in the *Canadian Alpine Journal*,[1] bearing in mind that Mounts Beaver and Duncan rise close to the watershed between the two rivers which also bear those names.

[1] *Canadian Alpine Journal*, iii. 26. See also *Geographical Journal*, xxxvii. 589, 601. Mr. Wheeler's promised map does not seem to have materialized.

The Dogtooth Range appears to be sub-alpine, and is disposed of in chapter v. of the Guide; but from the Beaver-Duncan divide to the neighbourhood of Wells Pass there is a continuous stretch of alpine country, which rivals in height, beauty and general interest the main Selkirk Range itself. The Spillimacheen Range has as yet hardly been touched, but south of Bugaboo Pass a series of energetic campaigns have, since 1910, been carried on from the Upper Columbia Valley. The district is far from being an 'exhausted' one, but the remarkable group of mountains situated between Horse Thief Creek and Toby Creek has been thoroughly explored and mapped.[1]

Some Minor Ranges.

It has been said that the range rapidly loses its interest to the south of Wells Pass, but it is rash to make such a statement in Canada, where the alpine area is being continually enlarged by fresh discoveries so rapidly that it is difficult to keep pace with them. In illustration of this, reference may here be made to an entirely unexpected alpine region found in 1912 in Vancouver Island, and to Dr. A. P. Coleman's recent explorations in the Torngats (Labrador) on the other side of the continent.[3]

Another outlying district which deserves mention, though not so recent a discovery, is the Garibaldi Range, near Vancouver City.[4]

The Main Chain from Laggan to Jasper.

Returning now to the main chain, there is nothing to be added, so far as the south side of the C.P.R. is concerned, to what has been already said. There remains the main chain to the north, which falls naturally into two sections—that lying beyond the G.T.P. railway, and that situated between the two railways, the largest, and in many respects the most interesting, of all the areas with which we have to deal. This section, or rather that part of it lying south of the Athabasca Pass, was divided by Dr. Norman Collie[5] into four main groups: (1) The Balfour (or Waputik) group, between the Kicking Horse Pass

[1] *Canadian Alpine Journal*, iii. 14, 26, 147, iv. 98, vi. 103, 112, vii. 12, viii. 17, 43.
[2] *Ibid.* v. 20, 44, 82.
[3] *Ibid.* vii. 5, 67, viii. 34.
[4] *Ibid.* iv. 140, viii. 121.
[5] *Climbing in the Himalaya and other Mountain Ranges*, p. 144. The whole of this chapter on the Rockies is still well worth reading.

and Howse Pass ; (2) the Forbes group, between Howse Pass and Thompson Pass, 30 miles farther north ; (3) the Columbia group, extending over the 35 miles from Thompson Pass to Fortress Lake Pass ; (4) the Mount Hooker group, between the Fortress Lake Pass and the Athabasca Pass, 25 miles farther. Sir J. Outram's divisions and subdivisions,[1] so far as they are carried, practically coincide with those of Dr. Collie. To these must now be added a fifth group, the mountains between the Athabasca and Yellowhead Passes, which may be called the Edith Cavell group. As far as the Athabasca Pass the range has a very definite western boundary consisting of the great trench of the Columbia River, and it is this portion of it which Sir J. Outram refers to when he says the Rockies are 60 miles in breadth. At the Athabasca Pass the range connects with the mass of mountains that separate the Columbia and Fraser River basins, and from this point northward no precise statement as to the breadth of the chain is possible.

Of the groups above mentioned the first falls within the C.P.R. district, and has been already dealt with ; the second and third were the scene of much climbing and exploration from 1898 to 1902, in which the leading part was played by Dr. Collie. He and Mr. Stutfield have described his three expeditions in *Climbs and Exploration in the Canadian Rockies*, one of the Alpine classics of Canada. The whole of this exploratory work is well summarized in the second half (chapters x.–xv.) of Sir J. Outram's book. Since that time the energies of pioneers have been diverted in other directions, and few, if any, additions have been made to our knowledge of the region.[2] The credit of having mapped it belongs to Dr. Collie ; all subsequent maps are based on his ; the only extensions of importance are due to Dr. A. P. Coleman.[3] A study of the records will show that there is still plenty of scope for exploration in groups 3 and 4, and if first ascents are not the principal object, groups 2, 3 and 4 probably offer as fine a field for climbing as any district in Canada.

[1] Op. cit. pp. 15–16.

[2] Mr. Eaton made some new ascents in the Freshfield Range, a subdivision of group 2, in 1910. *Canadian Alpine Journal*, iii. 1.

[3] *The Canadian Rockies, New and Old Trails.* A delightful book.

Attempts have been made to approach the crest of the range from the west by the lateral valleys descending to the Columbia River, but the travelling proved to be exceptionally bad even for the Rockies, and this line of attack is only mentioned to be dismissed. The explorations above mentioned were carried on wholly on the eastern side of the range, and the route generally followed holds so important a place in mountaineering geography that it must be described in some detail. Starting from Laggan, it ascends the valley of the Bow River, running parallel to the Waputik Range, to the Bow Pass. Thence it descends into the basin of the North Saskatchewan by the south branch of that river (also called Bear Creek, and, more rarely, the Mistaya River), and leaves it again by the north branch. Both these streams, as their names suggest, also run parallel to the main chain. At the head of the north branch the Wilcox Pass leads to the valley of the Athabasca, which also runs nearly due north, and is followed till the G.T.P. Railway is reached at Jasper. The ' air line ' from Laggan to Jasper is just 130 miles, and a good idea of the scale and character of the journey may be formed by comparing it with that from Chur to Martigny, which are almost precisely the same distance apart. Starting from Chur, the Vorderrhein represents the Upper Bow, and the Oberalp the Bow Pass. The Reuss corresponds to the North Saskatchewan, the Furca to Wilcox Pass, and the Rhone to the Athabasca. In each case the main chain is on the traveller's left hand, while other ranges of varying size and importance rise on his right, though, unfortunately, the Rockies have nothing comparable to the Bernese Oberland. Of course there is no correspondence, in point of distance, between the intervening points. Very roughly speaking, it is 70 miles to Wilcox Pass, the valleys of the Upper Bow and the two branches of the Saskatchewan being each a little over 20 miles in length, while it is about 60 miles from Wilcox Pass to Jasper. The early explorers all started from Laggan, and only one of them, Dr. Coleman,[1] followed the route here described throughout its whole length. It is scarcely necessary to point out how enormously its importance and value have been enhanced by the construction of the second line of railway.

[1] Op. cit., chapters xxvii.–xxix. See *Canadian Alpine Journal*, v. 84, 87.

The groups mentioned above are progressively more imperfectly known as one moves farther north, mainly owing to the difficulty of time and the necessity which formerly existed of a long return journey. The mountains north of Wilcox Pass can now be much more rapidly and easily reached from Jasper. Those which enclose the Whirlpool River are still almost untouched, and would well repay a prolonged visit. The best line of attack for those on the left bank (the fifth or Edith Cavell group) would probably be found by going through the depression to the west of Mount Edith Cavell. The ascent from the Whirlpool trail to it is steep, but a good packer could get horses up it. Mount Edith Cavell was approached by this route and climbed by Mr. E. D. Holway in 1915. Some of the mountains to the west of the depression look difficult.[1] On the opposite side of the Whirlpool, which in its ordinary condition is fordable here, a large valley running deeply into the mountains on the right bank looks well adapted to facilitate the exploration of the blank space on Dr. Coleman's map between the Whirlpool and Wood Rivers ; horses could probably be taken up it. The starting-point for this valley or for the Edith Cavell depression can be reached in three days from Jasper.[2]

Close to the Yellowhead Pass, Mount Fitzwilliam, a prominent rock peak, must be of exceptional interest as a view-point, and may be a good climb as well.

The Groups East of the Main Chain.

Of the groups situated to the east of the main chain, the one between the Bow and Saskatchewan Rivers can be traversed by the Pipestone Creek and Pass and Siffleur Creek. This route, which reaches the Saskatchewan a few miles below the confluence of its north and south branches, was several times used as an alternative to that by the Bow Pass ; and there are transverse passes from the Upper Bow Valley to both the Pipestone and the Siffleur Creeks, but the early explorers seem to have found no great inducements to linger in this region.[3]

[1] *Alpine Journal*, xxviii. 355 ; *Canadian Alpine Journal*, vi. 74, 84, vii. 63.

[2] Much new information as to the country round Jasper is contained in an article by Mr. M. P. Bridgland in the *Canadian Alpine Journal*, x. 70 ; and the recently published *Guide to Jasper Park* (see *ibid.* 105) would probably be found very useful.

[3] As to Mount Hector, see p. 576.

A much larger block of mountains is that which separates the Saskatchewan from the Athabasca, and gives rise to its important tributary, the Brazeau; its southern portion was crossed in three or four directions by Dr. Coleman,[1] who is the only authority on it that I have come across. In the northern portion, between Mount Brazeau and the Athabasca, is Maligne Lake, reached in 1908 by Mrs. Schæffer's party,[2] the first white visitors, via Poboktan Creek, and probably also accessible by a pass nearly opposite the mouth of the Whirlpool Valley. The few people who have visited Maligne Lake are remarkably enthusiastic about it, and, judging from photographs, the peaks round its head should prove very interesting to climbers. Much more is likely to be heard of them in the near future, as the lower end of the lake is only fifteen miles from Jasper by the valley—hitherto impassable for horses—of the Maligne River, up which a trail will certainly be made very shortly, if it has not been already completed, and the results of further investigation will have an important effect on the reputation of Jasper as a centre.

The Main Chain North of the G.T.P.

We now come to the mountains north of the G.T.P. Railway, which spread over an extensive and indefinite area, of which our present knowledge may be described as considerable but patchy. Mount Robson, the magnet which first drew explorers here in the pre-railway days, is, and must remain, the principal centre of interest. It is the great alpine asset of the G.T.P., and an hotel will probably soon arise somewhere near Mount Robson Station, opposite the mouth of the Grand Forks River, a tributary of the Fraser. Up the Grand Forks Valley the base of its western face—the best line of ascent—can now be reached in a long half-day, by rail and trail, from Jasper. Very full information with regard to this great peak, the highest in the Canadian Rockies, and its satellites and surroundings, is now available, but it would take too long to deal with it here.[3] Swift Current Creek and two or three other valleys descending into the Fraser

[1] See his map and book, chapters xvii., xxi. and xxvi.

[2] *Canadian Alpine Journal*, iv. 92; *Old Indian Trails*, by Mrs. Schæffer.

[3] Coleman, op. cit., chapters xxx.–xli.; *Geographical Journal*, xxxvi. 57, xxxix. 223; *Alpine Journal*, xxv. 293, xxvi. 5, 382, xxvii. 329,

below the Grand Forks were visited by Mr. Holway in 1915 and 1916; he reports: "A wonderful field for exploration, especially in the big bend of the Fraser." The same energetic explorer paid a brief visit in 1916 to the Cariboo Range, on the other side of the Fraser, probably the most important of the independent minor ranges.[1]

The main watershed immediately to the north of Mount Robson (Robson Pass) consists of a long flat plain, so level that the water issuing from the Robson Glacier flows both ways. All climbing hitherto has been done from camps on this plain, which was formerly inaccessible, except by actual climbing, from the much lower Grand Forks Valley, and attainable only by a roundabout route from the east via the Moose River and Pass. It can now be reached via the Grand Forks by a trail engineered in 1913, in seven or eight hours from Mount Robson Station. If an ascent of Mount Robson itself be the sole object, it would probably be the quickest way—as above suggested—to go up to a bivouac direct from the Grand Forks Valley; but the higher camping-ground on the divide is much the best centre for exploring the neighbourhood generally. The round trip by the Moose River route is also worth making for its own sake, especially if time permits of some climbing being done on the way. There are interesting expeditions to be made near the Moose Pass: Resplendent Valley, at the head of the West Fork of the Moose River, is well worth a visit, and, though the actual line of the divide has been laid down by Mr. Wheeler, there is still exploratory work to be done among the mountains between the East Fork and Grant Creek.

For the whole of this region Mr. Wheeler's map[2] is indispensable. The mountains facing Mount Robson *immediately* on the other side of the level plain above mentioned have all been climbed, but behind these there is a remarkable region which is still very little known. The range duplicates itself in a curious way difficult to explain on paper, enclosing a low plateau, along which, strange to say, the main divide seems to run. On the

xxx. 358 (summary of the expeditions of 1913); *Canadian Alpine Journal*, ii. part i. 1, part ii. 1, 21 (ascent of G. B. Kinney and D. Phillips), iv. 1, vi. 11–73 (the expeditions of 1913).

[1] *Canadian Alpine Journal*, vii. 63, viii. 30, 133.

[2] *Alpine Journal*, xxvi. 404; *Canadian Alpine Journal*, iv.

eastern side of the plateau is the Chown group, first visited by Dr. Collie's party in 1911.[1] Our further knowledge of the country in this direction is mainly due to Donald Phillips, who has made a rough sketch-map extending considerably farther north,[2] and conducted three expeditions farther still, through very difficult country, to Mount Sir Alexander [3] and Jarvis Pass. This is the farthest north yet reached by climbers. Whether there are any alpine regions beyond it is, I believe, quite uncertain.

North of the Yellowhead Pass there are no blocks of mountains to the east of the main chain, and definitely separated from it, of a character at all comparable to those found between the G.T.P. and the C.P.R.; but there is a considerable area lying just outside the limits of Mr. Wheeler's map, and shown as a blank on Dr. Collie's map, closely connected with the divide itself, which would certainly repay farther exploration, and is within fairly easy reach of Jasper. There are three possible lines of attack: First it may be possible to approach it from the west, by the Miette River; secondly, there is the valley of the Snaring River, which joins the Athabasca a few miles below Jasper: whatever else he may find there, all the charm of the unexpected awaits the first visitor to its mysterious upper basin. It is said to be very difficult, if not impossible, of access, but the attempt would be well worth making. Anyone contemplating it should, before starting, make the ascent of Pyramid Peak at the head of Jasper Lake, and carefully note what he sees from there. Lastly, there is the much larger Stony River,[4] which enters the Athabasca below Jasper Lake, and should provide a happy hunting-ground to a climber with topographical inclinations. The southern branch already referred to calls most urgently for attention, but higher up the main valley several fine glaciers offer tempting roads to the skyline. A pass at the head of the main Stony leads to the Smoky River, which it strikes just opposite the Chown group, and thus supplies an attractive though lengthy alternative route to the Robson region. There

[1] See his map, *Geographical Journal*, xxxix. 312.
[2] *Canadian Alpine Journal*, vi. 178, 186.
[3] *Ibid.* vi. 170, 188, vii. 82, ix. 79.
[4] See Dr. Collie's map and papers, *Alpine Journal*, xxvi. 5; *Geographical Journal*, xxxix. 223.

are some wild and striking rock peaks on the right hand of the traveller crossing this pass from Jasper, but apart from these, there is nothing beyond the Stony River of any interest to a climber.

An attempt on that remarkable mountain, the Roche Miette, is recorded in the *Canadian Alpine Journal*, ix. 141.

Modes and Manners of Travel.

Travel away from the railway, as has already been indicated, means travelling with a camp outfit and a pack-train. The business of 'packing' is a highly organized one, and it is a vocation which, in untrodden country at least, makes as severe demands as that of a guide, and more varied in character, on the courage and resourcefulness of those who follow it. The packers, indeed, hold a position which presents many analogies to that of guides in the Alps, and a first-rate packer, like a first-rate guide, is a treasure beyond all price. It may be as well to mention here, for the benefit of those who have not visited the Rockies, that they are a very independent set of men, and that the social distinctions which are universally taken for granted in Europe simply do not exist for them. The sooner and more completely the traveller can get himself into the same mental attitude on this point, the more pleasantly will he fare. He will also discover, if he keeps his eyes and ears open, that there is a very well-defined, unwritten code of camp manners, of which the outstanding rules are: Never grumble; never be impatient; never tell anybody to do anything, always ask him.

The usual way of making arrangements with a packer is to inform him, as long as possible beforehand, of the number of the party and the proposed duration of the trip. He then takes charge of everything, providing saddle-horses, pack-horses, tents, cooking equipment, provisions, etc., for a fixed sum per day: the only thing which the traveller is expected to provide is his bedding. In the C.P.R. district packing is now almost wholly in the hands of the Brewster Transfer Co. Ltd., whose head-quarters are at Lake Louise. They have a good reputation, and are said to provide good men. Their usual rates are—for one person $15 per day; for two persons $12.50 for each person; and $10 per day for three persons, "with liberal reduction for larger parties." Outside the C.P.R. district packing is still a matter of individual private enterprise; some of the packers

who formerly worked in the C.P.R. district have migrated to Jasper, and probably others will make it their head-quarters as time goes on; but at present the principal centre of the packers of Northern Alberta is at Lac St. Anne, near Edmonton. Their ordinary charges are about the same as those of the Brewster Company. (*N.B.*—Written in 1913; charges may now be higher.)

A few suggestions with regard to some of the above-mentioned items may be useful.

Outfit. 1. Having once tried the experiment of dispensing with saddle-horses, partly on general ascetic principles, partly with a view to getting into training, I have no hesitation in saying that it is a great mistake. If one keeps with the rest of the outfit,[1] it is dreary work; if one goes at one's own time and pace, trouble arises when rivers have to be crossed—either the traveller has to wait for the outfit or the outfit for the traveller (and to check a lot of pack-horses when on the move is a tiresome matter); while it is surprisingly easy for the unwary pedestrian to lose touch with the outfit altogether, even on such a well-trodden trail as the Jasper trail in pre-railway days.

2. The traveller should make sure that one of the tents is a *teepee*.[2] During a spell of cold, wet weather (and even snow is sometimes encountered in August at quite low levels) a *teepee* makes things much less intolerable. A packer with a large and varied experience of both summer and winter travel told me he preferred a large ordinary tent with a stove. I have no personal experience of this, but one or the other is essential. The other tents provided by the packers satisfy all ordinary requirements, but are sometimes inadequate under stress of prolonged wet weather. I once took a Whymper tent made of extra light material, which, besides being absolutely watertight, possessed two great advantages: first, it had a floor; secondly, it could be put up immediately on arriving in camp: other tents have to wait till the necessary poles can be cut down, and a good many other things have to be attended to before this can be done. The drawback to it—a serious one—was

[1] The whole caravan—men, horses, baggage, etc.—is generally compendiously referred to as an 'outfit.'

[2] A large Indian tent in which a fire can be kept going.

that the poles were inconveniently long for packing purposes: this might perhaps be got over by making the poles with two joints instead of one. A small Mummery tent for making a flying camp is not required so often as alpine experience would lead one to expect, but on the whole it is worth taking.

3. As to clothing, the same sort is required as in the Alps. It is well to bear in mind that one spends more time—generally much more time—'on the trail' than in climbing, and heavily nailed climbing boots are not very suitable for riding; they are apt to stick in the stirrups, which might easily be a source of great danger in case of a fall. Shooting boots with ordinary (not projecting) nails are much better for an ordinary's day's travel. Gloves are useful in riding through thick forest, and a silk neckerchief is some protection against mosquitoes. Fortnum & Mason, Jermyn Street, London, have a good camp boot which is also useful for this purpose.

Either a mackintosh or a suit of 'oilies' is indispensable for riding in wet weather. 'Oilies' are a more complete protection against rain, but difficult to get in and out of quickly, and appallingly hot when the character of the trail makes it necessary to dismount and walk. On the whole, a mackintosh is to be preferred.

For bedding, a couple of blankets are all that is required in fine weather; spruce boughs make a perfect mattress. But there is much to be said in favour of a camp-bed, especially if the tent has no floor to it. With an X-bed, a sleeping-bag and a blanket any weather can be faced with equanimity, and the extra weight of the bed is not a matter of importance. It is much more necessary that the packages containing one's personal baggage should be tightly packed, compact and easy to handle, than that they should be light. A couple of suit-cases (preferably of crushed cane) *not more than 26 inches long*, hold all that is wanted for a two months' trip, and go well on each side of a pack-saddle. A *chilamchi*[1] of the Indian type is useful, but rather unwieldy; it is easy to get a rather smaller basin (preferably *not* enamelled) at the Army and Navy Stores, and have a leather case specially made for it.

4. Camping out is very extensively practised in

[1] Metal basin in a leather case.

Canada, and it is quite unnecessary to think of taking out any special luxuries from England in the way of provisions. Anything of that nature, also whisky of excellent quality, and cigars (good and cheap), can be obtained at the Hudson Bay Company's Stores at Edmonton or Calgary. As to provisions generally, packers usually have a very good idea of what is wanted; but if one has any special preferences—e.g. for cocoa or coffee over tea—it is as well to mention them.

Season.

The season for climbing in Canada and weather conditions generally are, roughly speaking, similar to those in the Alps; but the season closes rather earlier, and the spell of fine weather which is so often met with in the Alps early in September does not seem to occur there. When well-trodden ground is left, it must be borne in mind that rivers are more likely to be troublesome early in the summer (i.e. till towards the end of July) than later on; but quite insignificant creeks may suddenly become impassable obstacles for a day or two at any time. Trails, moreover, which are not regularly used often deteriorate, and, as was remarked above, snowstorms sometimes make travel temporarily impossible even in August. The moral of all which is, that it is rash to try and work out cut-and-dried plans beforehand, so far as dates and times are concerned.

The Annual Camps.

No account of mountaineering in Canada would be complete which omitted to make mention of the Alpine Club of Canada, and the annual camps of its members in the mountains, which indeed have become the outstanding feature of mountaineering as practised by Canadians themselves. They are usually held towards the end of July, and last for eight or ten days. They are necessarily situated near one or other of the railways, but their area is sometimes extended by the formation of subsidiary camps, and parties for more distant expeditions are frequently formed when the camp breaks up. A climber intending to make a first acquaintance with the Rockies could not do so in a pleasanter and more profitable manner than by paying a visit to one of these camps, and for this and many other reasons he would be well advised to become a member of the club. The cordial welcome offered to English mountaineers generally, and to members of

the Alpine Club in particular, must be experienced in order to be properly appreciated, and it is hardly necessary to point out that the camps give an unequalled opportunity of obtaining first-hand information from the most authoritative sources with regard to topography, new expeditions, methods of travel and similar matters. If a visit to the camp was not practicable, the traveller, as a member of the club, could procure advice and assistance from its officials and other members which would otherwise be unattainable.

With regard to the journey from England, the following particulars were given in the invitation issued to members of the (English) Alpine Club in 1913 :

Access, Cost, etc.

"The steamer fare, first class, from Liverpool to Montreal is £18, 10s. each way (£11 by one-class boats).

"The cost of return ticket, first class, from Montreal to Laggan (C.P.R.) is £13. The extra charge for a berth in a sleeping-car is £6 for the double journey.

"The cost of return ticket, first class, from Montreal to Mount Robson Station (G.T.P.) is £14. The extra charge for a berth in a sleeping-car is about £6, 10s. for the double journey.

"The time occupied by the journey from Liverpool to Mount Robson or Laggan Stations is ten to eleven days."

N.B.—The voyage in one-class boats takes some days longer. A berth in the sleeping-car is practically indispensable. Two persons taking a 'compartment' can make the journey in far greater comfort at an additional expense of £2, 3s. each. The time and fares to Jasper would be rather less than to Mount Robson. The times from Liverpool to Laggan or Mount Robson Stations are short, and involve hard and continuous travelling. Full particulars, together with pamphlets, descriptive time-tables, etc., can be obtained at the London offices of the C.P.R. and the G.T.P., both in Cockspur Street, London, within one hundred yards of each other. The only alternative route to Montreal of any importance is that via New York, as to which see *Baedeker's Canada*.

INDEX

Accidents, mountaineering, causes of, 149, 256
—— how to deal with, 264–7
—— prevention of, 256–78
—— their effect on others, 264
Afanasief's *100 Kaukasus Gipfel* cited, 509, 510
Ailments, 9
Alpine Club of Canada, annual camps of the, 590
— Ski-ing, Calendar for, 402, 403, 456–70
Alps, the Dolomites of the Eastern, 47
— the Eastern, 201
— the High, hints for winter equipment for, 444–6
—— in spring, 456–68
—— in winter, 442–56
—— snow conditions in the, 446
— the Southern, 47
Amateur mountaineer, the, 108, 109, 134, 135, 136
—— improvement in his skill, 105, 106
Anchor, the, 220, 223
Anchoring on a descent, 191, 192
Andorra, 559, 560
Aneroid, 98, 445
— the Watkin, 535
Angle of lie of snow, the, 325, 326, 328, 329
—— reconnoitring, 375, 376
— of rock, 387, 388
Ankle, part played by the, in climbing, 158, 159, 289, 303
Anticipation in climbing, importance of, 157, 158
Arctic mountaineering, 497–505
Arms, use of the, in climbing, 161, 162
Association among climbers, 150
Automatic actions and adjustments in climbing, 69, 70
Autumn ski-ing, 468, 469
Avalanche ground, tactics on, 439–42
Avalanche, liability of snow to, 328
Avalanches, 273–5
— classification of, 427, 428
— conditions for their production, 273, 423–7
— dangers of, 424, 425, 426, 430, 432, 433–8
— dry powder, 428, 429
— ground, 423, 427, 435
— in Norway, 545
— new wet snow, 429–31
— old wet snow, 435–8
— power of, 274, 428, 435, 436
— rock, 271
— summer snow, 438, 439
— wind slab, 431–4
Axe, the, 91, 92
— as an extra hand, 206, 207
— as a third leg, 178, 207, 292
— in descent, 208
— on rocks, 204–8
— on snow, 336, 337

Baedeker's Canada cited, 574, 577
— *Norway* cited, 536
— *S.W. France* cited, 570
Balaitous, the, 557
Balance climbing, 144–8, 156, 157
— factors involved in, 28–32, 140, 149, 156, 157
Barometer. *See* Aneroid
Bath, the hot, 5
— in tropics, 479
— morning, cold, 4
Bathing, 12, 13, 524, 532
Bed, portable, 99
Beginner, the, 113–6, 118
— his choice of trainer, 114, 115
Beginners, initial practice for, 148, 152, 153; and *see under* Rope
Behind, the rope, 215
Belay, the direct, 220, 221
— the indirect, 221, 222
Belays, 219–25
Belloc's *Pyrenees* cited, 570

Benightment, 52, 53, 74, 75
Bergschrund, 317, 337
Bhutan, 527
Bise, the, 446
Bivouac, outfit for, 99
— selection of a, 53
Blindness, snow, 11, 343
Blistering from sun, 11, 12, 90, 97
Blizzards, danger of, 276
Body brake, the, 196
Boils, 484, 485
Boots, 4, 80, 81, 82, 153–5
— canvas, 155
— care of, 81, 82
— for the Himalaya, 534
— for ski-ing, 402
— nailing, 82, 83, 154, 155
— rubber, 89
Boracic powder for the feet, 5
Boredom, 15, 16
— of tramps over snow, 332
Bouldering, 153, 171, 183
Boum, the, 562
Brakes, 195, 196
— for glissading, 358, 359
Breeches, 87, 88
Breithorn, ski-ing on the Zermatt, 397
Bridges, ice, 337, 338
Bridgland's *Guide to Jasper Park*, etc., cited, 583 n.
Britain, mist and cloud in, 389, 390
— rocks in, 388, 389
— snow in, 342
Bruce's *Kulu and Lahoul* cited, 529
Bucket steps, 297

Calendar for Alpine Ski-ing, 402, 403, 456–70
Camera, the folding, 471
— the hand, 471, 472
— the Verascope, 478
Canadian Pacific Railway District, the, 574–81
Canteen for tropics, 487, 488
Canvas boots, 155
Capo al Dente, the, 519
Carriers in tropics, 495
Casque, the, 560
Caucasus, the, climate of, 506
— forests of, 508
— literature of, 509, 510
— maps of, 515, 516
— modes of travel in, 511, 512, 514, 515
— mountain system of, 508
— mountaineering in, 506–16
— — centres for, 512
Caucasus, mountaineering in, commissariat for, 513, 514
— — cost of, 516
— — equipment for, 512, 513
— records of, 508
— routes of access to, 510
— topography and structure of, 506–9
Caulfield's *How to Ski* cited, 398 n.
'Chair,' the, 196, 197
Chalk, its peculiarities and risks, 180
Chamois, as a danger, 271
— in relation to avalanches, 441
Chamonix Aiguilles, the, 46, 47, 277
— granite, 146
Check, easing of a, 258–60
Checking on the rope, 259, 260
Chill, avoidance of, 85
— risk of, 5, 6, 7, 13
Chimney climbing, 167–9
Chimneys, descent of, 191
Chocolate, 6, 445
Christiania turn, the, 401
Claws, 96, 97, 287–94
— in glissading, 365, 366
— in mountain ski-ing, 402, 419
— their value, 286, 294, 513
— theory of their use, 288, 289
— types of, 287, 288
Cliffs, sea, 181, 182
Climbing down, 184–99
— in combination, 209–55
Closti turn, the, 401
Clothing, 5, 11, 84–90
— for the tropics, 488, 489
— for women, 89, 90
— for the Himalaya, 534
Clouds as weather portents, 57–9
— cirrus, 58
— cumulus, 58
— 'fish,' 59
— 'mare's-tails,' 58
— stratus, 58
— thunder, 59
Coat, the, 84, 85, 86, 87, 90
Col du Lion, the, 57
— Theodule, the, 57
Cold, effect of, on endurance, 10, 11
Coleman's *The Canadian Rockies, New and Old Trails*, etc., cited, 581n., 582, 583, 584, 586
Collective confidence of party, 17, 18, 240
— rhythm, 209, 211
Colour photography, 477
Combination, climbing in, 209–55
— the secret of time-saving, 76
Comolo Forno, the, 559

Compass, 98
— the radium, 52
Confidence, danger of over-, 24, 25
— necessity of self-, for leader, 17, 238
Confusing effects of weather when on snow, 342–5
Conjunctivitis, 483
Constipation, 480, 481, 482
Continuous going, 76–8
Cooking apparatus, 98
Cornices, snow, 338–40
—— double, 380
—— reconnoitring, 377–80
Cornwall, cliff climbing in, 181
Corsica, literature of, 520
— modes of access to, 518
— mountaineering in, 517–21
—— centres for, 518, 519
—— cost of, 518 n.
—— equipment for, 517, 518
—— season for, 517
— nature of climbing in, 520
— topography and maps of, 518–21
Coughs and colds, 482
Couloirs, 268, 272
— glissading on claws in, 365
— reconnoitring, 382–4
— snow in, 340–2
— the plunging step in, 364, 365
Courage, the measure of, 261, 262
Courmayeur, weather in, 56
Cover for the axe, use of a, 349
Crabioules, the, 561
Cracks, climbing, 165, 166
— descent of, 191
Crampons. *See* Claws
Crevasses, 316–21, 452, 455
— hidden, 315–22, 449
— marginal, 309, 450
— reconnoitring, 381, 382
— scimitar, 310
— systems of, 309–11
Crust, snow, 301, 331
— effect of Föhn on, 413
———— frost on, 414
———— sun on, 415
—— film, 414
—— forms of, 410, 411
—— marble, 411, 414
—— perforated, 414
—— soft breakable, 410
—— trap, 410
—— unbreakable, 410, 411
Cups, drinking, 98
Cushion, rubber, 99
Cuts and scratches, 485
Cutting. *See under* Steps
Cylindre, the, 560
Damp, risks of, 5
Dancing, as training, 4, 66, 156
— movements analogous to those of climbing, 156, 157, 208
Danger, 26, 27, 72, 149, 152, 237, 260, 261
De Déchy's *Kaukasus Reisen und Forschungen* cited, 509
Descent, 42, 184–99
Detached rock, 176, 177
Diarrhœa, 481
Direction, the sense of, 345–7
Disappointment, 24
Discipline of parties, 2, 3
District, the choice of, 43–8
Dogtooth Range, the, 580
Dollfuss in May, 461
Dom, the, 459
Doubled rope, the, in descent, 192–5
— on glaciers, 317–21
Down, climbing, 184–99
Drinks, 7, 8
Dru, the, 47, 152
Dunagiri, 529
Dysentery, 481, 482

Earth glissade, 182
Earthquakes, 277, 278
Ebnefluh, ski-work on the, 398, 459, 468
Eckenstein, Mr., crampons designed by, 92, 96, 288
— ice-axe designed by, 92
— on knots for Alpine ropes, 94, 95
— on nails for boots, 83
— on ropes for Alpine work, 93, 94, 95
Elbrus, 509
End man, dangers of his fall, 260
Equipment, for Alps, 80–8
— for Arctic mountaineering, 498, 499
— for Caucasus, 512–4
— for Corsica, 517, 518
— for Himalaya, 532–5
— for mountain ski-ing, 402
— for Norway, 539, 540
— for Pyrenees, 566–9
— for rock climbing in Britain, 88, 89
— for Rocky Mountains, 588–90
Ewige Schnee, 330
Exceptional ascents, 120–2, 149
Excitement, dangers of over-, 16
Exercise, forms of preliminary, 4, 156, 158, 159, 181
Exhaustion, 26, 27

Experts, guide and amateur as, 111, 112, 118, 119
Eyes, right use of the, in climbing, 146, 147, 166, 184, 185, 186, 187, 192, 312, 313, 321, 370–396

Face-inward position in descent, 190, 191
— — in glissading, 363, 364
Face-outward position in descent, 188, 189
Face-sideways position in descent, 189, 190
Fall, 256
— after a, 262–4
Fallibility, human, 256, 257
Fatigue, temper as a sign of, 20
Fear, 26, 27
Feet, care of the, 4, 5, 83
Fell climbers, 142
Fellowship, necessity of good, 3
Fencing as training 4, 66
Fiescherhorn, the, 468
Finsteraarhorn, the, 442
Finsteraarjoch Pass, in winter, 397
Firn, 285, 330
First man on the rope, duty of the, 237–9
Flysch, 425
Fog. *See* Mist
Föhn, the, 59, 60, 61, 417–22
— effects of, on snow, 326, 328, 377, 380, 412, 413
— in spring, 421, 422, 436
— in winter, 418–21
— the dry, 418, 430
— the wet, 413, 418, 429, 430
Folgefond, the, 542
Following and leading, 217, 218
Food, the choice of, 6
— — for tropics, 486, 487
Foot brake, the, 195
Footing, the right, for guide and climber, 125–9
Footwork, 140, 141, 153–8, 161, 176
— for balance climbing, 282–4
Forbes, Prof. J. D., his *Norway and its Glaciers* cited, 536
Fourcanade, the, 556, 562, 563
Freak climbs, 182, 183
Freshfield's *Round Kangchenjunga* cited, 527
Freshfield and Sella's *The Exploration of the Caucasus* cited, 509, 515
Front, the rope in, 214, 215
Frost-bite, precautions against, 5, 288 n.
— remedies for, 10
Frostisen, 544
Fruit ice, 8
Funicula, 254, 255
Furka, the, 464

Gabbro, 542, 543
Gabiétou, the, 560
Gaiters, 84
Galdhöpiggen, 544
Galenstock, the, 463, 464
Galmihorn, the, 459
Garhwal, 528
Gauli Hut, the, 457
Géant, the Dent du, 152, 201, 278
Geology, value of knowledge of, 425, 426
Giddiness, 9, 28–31, 182
Gjækkevarre, the, 542
Glacier falls, 311, 314
— mills, 310
Glaciers, 279–81, 285, 308–24
— in the Himalaya, 531
— in New Zealand, 554
— in Norway, 545, 546
— in the Pyrenees, 556–62
— in the Rocky Mountains, 586
— in Spitsbergen, 503, 504
— practice in ice work on, 285, 286
— ski-ing on, in winter, 448–56
— snow-covered, 314–22
Glacier work, 308–24
Glasses, field, 97, 98
— for prevention of snow-blindness, 11, 97, 321, 322, 534
— for reconnoitring, 395
Glazed rock, risks of, 170, 171, 193
Glissading, 348–69
— alternate, 362, 363
— arrest of, 352
— face-inward, 363, 364
— jumping while, 357, 358
— on claws, 365, 366
— — in couloirs, 365
— on earth, 182
— on grass, 368, 369
— on heather, 368, 369
— on ice, 349–52
— — position for, 349–52
— on sand, 366
— on scree, 366–8
— on snow, 353–66
— on volcanic ash, 366
— — braking, 354, 355, 358, 359, 360

Glissading, positions for, 353–61
—— steering, 355–7
— stone tests for, 361
— the axe brake for, 354, 358, 359
— the foot brake for, 358, 359
— the rope in, 361, 362
Glittertind, 544
Gloves, 10, 86, 89, 195, 258
Goats as a danger, 271
Grand Trunk Pacific Railway, the, 582–4
Grease on the face, 11, 90, 97
Gredetschthal, the, 459
Grépon, the, 47, 152, 385
Grimsel region, the, 425, 463
Grip climbing, 142, 143, 145, 174, 176
Gritstone, 180
Grove's *The Frosty Caucasus* cited, 509
Grundlawinen. *See* Avalanches, ground
Gspaltenhorn, the, 447
Guide as mountaineer, the ideal, 107, 108
— companionship of amateur and, 128, 129, 136, 137
— nature, 123–37
Guides, Alpine, changed conditions of, 103, 104
— as experts, 111, 112, 119
— care for their comfort, 126, 127
— estimation of their qualities, 53–5
— management of, 123–37
— misconceptions of their function, 101–3
— question of engaging, 118–22
— traditional idea of, 102
Guides' books, hints as to writing up, 53–5
Gullies, 141, 142, 268
— glissading in winter, 368
Gurla Mandhata, 528, 529

'Half step' trick, the, 37
Halts, 40, 77, 78, 332
— the rope during, 251, 252
Handholds, to cut, in ice, 298
Hands, use of the, 161–7
Hat, the, 85, 89
Headaches, 9
Health, importance of, 3, 4
Heart, training and development of the, 67, 68
Height, advantages of, 71
— the psychological effect of, 31, 32, 293
Helmet, woollen, 86
Hill-shock. *See* Hysteria
Himalaya, the, climbing conditions in, 523, 525, 526
— configuration of, 522, 523
— glaciers of, 529
— management of expedition to, 523–525
— mountaineering in, 522–35
—— clothing for, 534
—— cost of, 531, 532
—— equipment for, 528, 532, 533, 535
—— food for, 533
—— hints for, 533, 534
—— instruments for, 535
—— season for, 526
—— use of claws in, 288 n.
— topography of, 527–9
Hindu Khush, the, 530, 531
Hochgebirgskalk, 425
Holding the rope, 225–7
Holds, anatomical, 244
— cling, 161–2
— finger, 161
— friction, 160, 161, 169
— on rock and ice, practice of, 69
— over, 162
— press, 163, 164, 179
— pull, 174, 177, 179
— push, 163
— side, 162
— under, 162
Humours, preventable, 14–7
Hurry, the blunder of, 38, 39, 40, 76, 77, 332
Hut usages, 48–50
Hysteria, or hill-shock, 26–8

Ice, black, 285, 288, 294, 374
— blue, 284
— glacier, 284
— grainy, 284
—— hard, 290, 291, 545
— honeycombed, 374
—— rotten, 290, 294
—— soft, 290
— snow, 285
Ice axe. *See* Axe
Ice claws. *See under* Claws
— climbing in relation to rock climbing, 282–4
— craft, 282–324
— fragments, danger from falling, 275, 276
— sky, the, 393, 394
Imitation, in collective climbing, 211–3
Incudine, the, 520

Infection of leader by party, 25, 26
Injured man, a danger to his party, 260, 261
Instruments, 57, 535
Ireland, cliff climbing in, 181, 182, 391

Joanne's *Pyrénées* cited, 570
Jungfrau, first winter ascent of, 397
Justedals-brae, the, 545, 546

Kamet, 529
Kasbek, 512
Kashmir and Karakoram, 530
Kellas, Dr., on Sikkim, cited, 527, 528
Kletterschuhe, 96, and *see* Soles
Knee, right use of the, in climbing, 146, 160
Knickerbockers, 85
Knots for ropes for mountaineering, 94, 95, 96, 255
— tests of, 96
Knutshultind, 544
Kumaon, 528

Lakes, the, 140, 152
— snowcraft in, 342
Lantern, folding, 52, 98
Lava, old, 180
Leader, duties of the, 1, 6, 8, 9, 10, 13, 18, 23, 39, 43, 44, 48–55, 125, 150, 151, 237–9, 323, 332
— guide or amateur as, 109, 111
— qualifications for, 1, 2, 3, 4, 9, 14, 15, 16, 19, 20, 21, 25, 33, 56, 150, 151, 237, 238, 239, 321
— responsibilities of, 2, 6, 9, 10, 16, 17, 27, 32, 34, 35, 36, 38, 39, 111, 133, 134, 150, 151, 153, 227, 237–9, 260, 261, 263
Le Blonde's, Mrs., *Mountaineering in the Land of the Midnight Sun* cited, 536
Leeches, 484
Lens, 471, 473
Light, to procure a, 52
Lillienfeld ski, 398
— system, 399, 401
Limestone, 180, 181
Loads, risks of unnecessary, 22, 75, 76
Long rope, the, 198, 199
Longstaff, Dr., on the Purcell Range, cited, 579
Loops in ropes for glacier work, 320

Lumière autochrome, the, 477
Lungs, training and development of the, 67, 68
Lunn's *Cross Country Ski-ing* cited, 398 n., 402
Lyskamm, the, 4

Malaria, 480
Maps, 98
Marble, 180
— crust, 411, 414
Marboré, the, 557
Mascot, uses of a, 34
Matterhorn, the, 57, 112, 113, 201, 271, 272, 381, 386
Maupas, the, 562
May in the High Alps, 456–61, 463, 464
Medicine chest for tropics, 485, 486
Medicines, 100
Merzbacher's *Aus den Hochregionen des Kaukasus* cited, 509, 515
Mind, influence of, on the body, 14, 129, 240
Mist and cloud, uses of, 389, 390
— dangers of, 277, 343, 346
Moine, the, 152
Mont Perdu, the, 559, 560, 561
Monte Cinto, 520
— Corona, 519
— d'Oro, 519
— Padro, 519
— Renosa, 519
— Rosa, 446, 457, 468, 469
—— ski-ing on, 397
Moraines, 178, 208, 292
Mosquitoes, 480, 540
Moods, abnormal, 23–8
Mount Assiniboine, 575
— Ball, 575
— Beaver, 579
— Cook, 551, 553
— Duncan, 579
— Edith Cavell, 575, 583
— Fitzwilliam, 583
— Hector, 576
— Moloch, 577
— Robson, 584, 585
— Sir Sandford, 579
— Torlesse, 553
Mountain photography, 471–8
— sickness, 9, 10
Mountaineer, the amateur, contrasted with the guide, 103–8
— the composite, 106
— the moderate, 116–8
— the true, 280
Mountaineering in winter, 397

Muffler, 86
Mumm's *Five Months in the Himalaya* cited, 528 n.
Mummery's *My Climbs in the Alps and Caucasus* cited, 509
Mürren, 469
Muscular fitness, 9, 65, 66

Nails, special, for climbing boots, 82, 83, 154
Nanda Devi, 529
Napes ridges, the, 152
Natives, management of, 494, 495
Nepal, 528
Nerve, 70
— exhaustion, 9, 26, 27
Nerves, 68, 69
Névé, 285, 330, 335, 448, 465, 470
Neve's *Picturesque Kashmir* cited, 530 n.
New Zealand, flora and fauna of, 553, 554
— glaciers in, 554
— guides for the Alps of, 549
— mountains of, 550, 551, 555
— routes to, 548, 549
— the Southern Alps of, 548–55
— topography and structure of, 551–3
— weather of, 550
Night dangers. *See* Benightment
Night, hints for walking at, 51–3
Norway, glaciers of, 540, 541, 542, 543
— guide books and literature, 536, 537
— local conditions in, 544–7
— mountaineering in, 536–47
— — equipment for, 539, 540
— — expense of, 538, 539
— — guides for, 540, 541, 542
— — season for, 537
— mountains of, 542–4
— routes of access to, 538
— topography and structure of, 542–4
Norway and Sweden, wind-swept snow in, 408
Numbers suitable for parties, 34, 35

Oberaarjoch, the, 463, 464
Oberland, the, crossed on ski, 397
— its opportunities and characteristics, 45, 46
— weather in the, 57
Obstinacy, hysterical, 28
Old age, climbing in, 73
Oppenheim's *New Climbs in Norway* cited, 536
Order, the, on the rope, 227–36
— of moving on the rope, the, 236, 237 ; and *see under* Rope
Outfit for the Alps, 91–100
Outram's *In the Heart of the Canadian Rockies* cited, 574, 581
Overhang, in descent, 194, 195

Pace, adjustment of, to the task, 74–9
— setting the, 37
Packe's *Guide to the Pyrénées* cited, 570
Paglla Orba, 521
Palmer's *Mountaineering and Exploration in the Selkirks* cited, 578 n., 579
Panic, 27, 272
Parasites, body, 484
Passing ahead, 37, 38
Paulcke, 397
Pegs and aids, 96, 200–3
Pennines, characteristics of the, 46
Perdighero, 561
Persistence in uncertain weather, 63, 64
Perversity, mountain, 267–72
Photography, mountain, 471–8
— — choice of subjects, 475–7
— — equipment for, 471–5
— — in colour, 477
— — stereoscopic, 477–8
Pic d'Albe, 562
— d'Astazon, 560
— de Bécibéri, 559
— d'Enfer, 557
— Long, 559, 561
— du Midi d'Ossau, 556, 557
— Moulières, 562
— du Munia, 561
— de Nethou, 559, 562
— de la Pique, 562
— de Pinède, 561
— du Port d'Oo, 561
— des Posets, 559, 562
— de Salenques, 562
Pitons. *See under* Pegs
Port de Venasque, 562
Positions in descent, 187–91
Powder snow, 326, 327, 405–11
— — effect of sun on, 408–11
— — — wind on, 407, 408
— — the ideal ski-ing surface, 406
— — reconnoitring, 374
— — in spring, 412–7, 430
— — in winter, 411, 412
Preparations, psychological, for ascent, 129, 130

Punta di Capella, 520
Purcell Range, the, 579–80
Putties, 89, 125, 289
Pyramid Peak, 586
Pyrenees, the, 556–71
— centres for climbing, 560
— huts and inns, 566
— literature of the, 570
— maps of, 564–6
— mountaineering in, 556, 557, 563
—— cost of, 569
—— equipment for, 566–9
—— guides for, 563, 564
— topography and structure of, 557–563

Quairat, the, 561
Quarries, scrambling in, for practice, 181
Quartz, its peculiarities and risks, 179, 180

Rabot's *Au Cap Nord* cited, 542
Reach, advantages of, in climbing, 71
Reconnoitring, 370–96
— angle on snow, 375–7
— couloirs, 382–4
— glaciers, 311–4, 381, 382
— the half-seen, 390, 391
— ice, 374, 381, 382
— importance of, 370–3
— ridges, 386, 387
— rock, 384
— rock faces, 384–6
— rocks in Britain, 388–90
— slabs, 387, 388
— snow cornices, 377–80
— snow surface conditions, 374, 375
— the unseen, 391–6
— wind and snow signs, 380, 381
Réquin, the, 152
Rescue parties, 266, 267
Rhone Valley, the upper, 424
Rhythm, balance, 144, 156, 157
— collective, 209–11
— of movement, importance of, 140, 141, 143, 145, 148, 156, 157
— of step, importance of, 39, 40, 41, 76, 77, 78, 79, 145, 148
Rib riding, 169
Ring, use of the, 193
— risks of the, 194, 198
Ringworm, 484
Ripple mark, 407
Roche Miette, the, 587
Rock avalanche, 271
Rock climber, the good, 138, 146–9, 171
Rock climbing, 138–208
—— in relation to ice climbing, 282–4
—— development of, 138–44
Rock sky, the, 393
Rocks, knowledge of structure of, 138
— in Britain, 388, 389
Rocky Mountains, access to the, 574, 591
—— literature of the, 574, 586
—— maps of the, 576, 579, 581, 585, 586
—— minor ranges of the, 580
—— modes and cost of travel in the, 587–8
—— mountaineering in the, 572–91
———— guides and equipment for, 578, 588–90
—— topography of the, 572–87
Rope, best handgrip on the, 225
— carrying the, 253
— choice of the, 93–4
— coiling the, 246, 252, 253
— in collective climbing, 213–7
— danger of abuse of the, 216, 217
— drying the, 253
— first man on the, 237–9
— frequent examination of the, necessity for, 253
— on ice, 305–8
— kinks in the, 253
— length of the, 253, 254
— management of the, 246–55
— order of moving on the, 236–7
— order on the, 227–36
—— on difficult or new ascents and descents, 228
—— on direct ascents and descents, 227, 228
—— on easy ascents and descents, 228
—— on traverses, 229–32
—— with beginners, 233–6
— right use of the, in descent, 191–9
—— on snow, 335–7
— second man on the, 239–45
— third man on the, 245–6
and *see under* Doubled, Knots, Long, Funicula, and Halts
" Rope-riding," 217
Rosenlaui, 461
Ross's *A Climber in New Zealand* cited, 554
Rubber soles, 155, 182
Rucksack, the, 5, 91
Rulten, 545
Running as training, 4

Russell's *Grandes Ascensions des Pyrénées* cited, 570
— *Souvenirs d'un Montagnard* cited, 570

Safety-pins, 85, 86
Sandstone, risks and peculiarities of, 180
Sark, the island of, cliff climbing on, 181
Schaeffer, Mrs., her *Old Indian Trails* cited, 584 n.
Schneebrett. *See* Wind slab
Schrader, M., on the Pyrenees, quoted, 557
Scotland, cliff climbing in, 181, 182
Scottish mountains, snow craft on, 342
Scree, 178, 179
— glissading on, 366, 368
— in relation to ski-ing, 426
Sea cliffs, 181, 182
Sealskins for ski-ing, 402, 449
Season, habit of the, 62, 63
Second man on the rope, the, duty of the, 239–45
— — — in case of accident, 262, 263
Selkirk mountains, the, 577–9
Séracs, 275, 301, 313, 335
Shirts, 85, 88
Signals, code of rescue, 51, 266
Sikkim, 527
Silence, dangers of, 18, 20, 51, 238
— uses of, 23, 240
Simla Hill States, the, 529
Sitting glissading, 360, 361
Skagastölstind, 542, 544
Skating movements, analogous to those of climbing, 156
Skavla, 408
Ski, mountaineering on, 397–470
— Lillienfeld, 398
— for mountain work, 402
— for summer work, 64, 397, 469, 470
Ski-ing in the High Alps, 399, 400
— Lillienfeld system of, 399, 401
— Norwegian style of, 399
— technique of, 398–401
— turns, 400, 401
— Zdarsky's system of, 398
Skin diseases, 483
Skipping as training, 4, 66
Sky, ice as affecting its tint, 393, 394
— rock as affecting its tint, 393
— snow as affecting its tint, 392, 393
Skye, climbing in, 152
Slab climbing, 142, 143, 166, 167, 387, 388
Slate, its peculiarities and risks, 179
Sleeping sack, 99, 498, 499, 513, 532, 567, 589
Sleeplessness, 483
Slides, photographic, 473, 474
Sling for axe, 93, 298
Slings, rope, 193, 194
Slingsby's *Norway the Northern Playground* cited, 536
Slips, how to accept, 41, 42
Smoking, 89
Snake-bite, 484
Snow a bar to starting, 63, 64
— avalanches, 423–42
— bridges, 337
— cornices, 338
— craft, 16, 325–46
— — for ski-ing, 403, 404
— crusted, 331
— — reconnoitring, 374
— granular, 416
— in couloirs, 340–2
— new, risks of, 327
— pink, 546
— powdery, 326, 327; and *see under* Powder snow
— the rope and axe on, 335–7
— sky, the, 392, 393
— slides, danger of, 273–5
— slopes, reconnoitring, 375–7
— — security of, 329, 333–5
— soft, its risks and difficulties, 330–332
— spring, for ski-ing, 412–7
— steps, 333, 334
— summer, for ski-ing, 422, 423
— travail, 330–3
— winter, for ski-ing, 411, 412
Snow-blindness, 11, 343
Snow-line, the, 459
Snow-water, its supposed danger, 8
Social composition of a party, 32–6, 109, 110, 150
Socks, 4, 5, 10, 83, 87, 88, 89, 155, 156
Soles, hard, 153, 154
— rubber, 155, 182
— soft, 154, 155, 171, 179, 284
Solitary climbing, 151, 152
— — unjustifiable on snow or ice, 315
Soum de Raymond, 560
Spectacles. *See under* Glasses
Spender and Llewellyn Smith's *Through the High Pyrenees* cited, 570
Spitsbergen, coast of, 500–2
— glaciers of, 501, 502, 503, 504
— interior of, 502–4

Spitsbergen, modes of access to, 497, 498
— mountaineering in, 497–505
— — cost of, 505
— mountains of, 502–4
Spring in the High Alps, 456–68
— snow for ski-ing, 412–7
— Time-table for ski-ing, the, 466–8
Springing the rope, 197, 198
Stances, on rock, 218, 219, 223–7, 246, 247
— on snow, 336, 337
— on ice, 298, 306, 307
Stedtind, 544
Stemming turn, the, 400, 401
Step-cutting practice, 182
Steps, cutting, 294–302
— using, 302–5
Stereoscopic photography, 477, 478
Stick, use of the, in ski-ing, 399, 400, 401, 442, 450, 454
Stimulants, their use, 7, 8
— — in the tropics, 487
Stockings, 83, 86, 155
Stomach, care of the, 4, 5, 86, 479, 480, 482
Stones, dangers of falling, 250, 251, 268–73
— reconnoitring couloirs for, 382–4
— — faces for, 386
Storm Mountain, 575
Strahlegg Pass, crossing in winter, 397
Strandaatind, 543
Strata, rock, importance of acquaintance with, 383–5, 388, 425, 426
Stutfield and Collie's *Climbs and Explorations in the Canadian Rockies*, cited, 575 n., 580 n., 581
Subconsciousness, sphere of, in mountaineering, 69
Sulitelma, 544
Summer ski. *See under* Ski
Sun, dangers of, 11
Sunburn, 90, 97
Sunstroke, 12, 482
Sutherlandshire, cliff climbing in, 181
Sweater, 86, 88
Sweet-stuffs, value of, 6, 7
Swimming as training, 66

Taillon, the, 557, 560
Teeth, care of the, 479, 480, 482, 483
Tehri Garhwal, 529
Telemark turn, the, 400, 401
Temper of mountaineering party, the, 19–23
Tennis as training, 4
Tents, 99, 513; and *see* Equipment
— for tropics, 491–3
— Mummery, 492, 499, 533
— *teepee*, 588
— Whymper, 491, 532
Thawing of snow, the, 409, 415, 416
Thigh brake, the, 195, 196
Third man on the rope, duty of the, 245–6
Thirst, 7, 8
Thunderstorms, danger of, 276
Tirich Mir, 531
Tour de Marboré, 560
Tourist, the mountaineer, 112, 113, 118
Trade goods for tropics, 494, 495
Training, 65–73
Trap crust, 410
Tricouni nails for boots, 82, 83
Tripod for camera, 472, 474
Tropical diseases, 480, 481
— mountaineering, 479–96
— — equipment for, 486–93
— — health in, 479–86
— — management of expedition for, 493–6
Tryfan, the buttresses of, 152

U.H.U. Stollen nails for boots, 82
Underwear, 88, and *see* Equipment
Unsound rock, 173–9
Unusual rock 179–83
Urbachthal, 424, 457

Val d'Evoléna, 46
Vanesta packing-case, the, 493, 494, 532
Verascope camera, the, 478
Vertigo, 28–31
Vignemale, the, 557, 561

Waistcoat, the, 85
Wales, cliffs in, 142, 152, 181, 182, 391
— North, snowcraft in, 342
Walking as training, 4
— manners, 36–41
— notes on hill-, 41–3
Warmth, the conservation of, 5
Warning, to give, 257, 258
Water-bottles, 98
Waterproof cape, 86
Weather, the, 56–64
— alternating, 44, 45
— confusing, 342–5
— evil, 276, 277
— signs, 60–2

Weight handicaps, 75, 76
Wet rock, risks of, 169, 170
Wetterhorn, the, 456, 457
— — first winter ascent of, 397
Wheeler's *Selkirk Range*, etc., cited, 577
White's *Sikkim and Bhutan* cited, 527
Wilcox's *Camping in the Canadian Rockies* cited, 575 n.
Will, function of, in climbing, 68
Wind, an enemy, 11, 258, 276, 343
— a friend, 277, 380, 381
— as weather portent, 59–60
— effect of, on snow, 326
— protection against, 5
Windboard, 407, 408, 432
Wind 'signs,' 380, 381
Wind slab, 432, 433
Wine, 7
Winter conditions in the High Alps, 442–56
— mountaineering, 397
— snow for ski-ing, 411, 412
Woman mountaineers, dress for, 89, 90
Wood-chopping as training, 4

Young climbers, care of, 13, 14

Zermatt, weather at, 56, 381
Zinal Rothhorn, 446, 447, 462

PRINTED BY
MORRISON AND GIBB LIMITED
EDINBURGH

RETURN TO the circulation desk of any
University of California Library

or to the

NORTHERN REGIONAL LIBRARY FACILITY
Bldg. 400, Richmond Field Station
University of California
Richmond, CA 94804-4698

ALL BOOKS MAY BE RECALLED AFTER 7 DAYS

- 2-month loans may be renewed by calling (510) 642-6753
- 1-year loans may be recharged by bringing books to NRLF
- Renewals and recharges may be made 4 days prior to due date

DUE AS STAMPED BELOW

NOV 15 2005

DD20 12M 1-05

UNIVERSITY OF CALIFORNIA, BERKELEY
FORM NO. DD6 BERKELEY, CA 94720

LD 21A-50m-11,
(D3279s10)476

General Library
University of California
Berkeley

YC 10167
U.C. BERKELEY LIBRARIES
C006722641